HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Services in changing conditions: heatwaves in the context of municipal home care in Helsinki

University of Helsinki

Master's programme in
Environmental Change and
Global Sustainability

Master's thesis
May / 2021
Milla Suomalainen

Supervisor: Eva Heiskanen

UNIVERSITY OF HELSINKI

Tiedekunta - Fakultet - Faculty	Koulutusohjelma - Utbildningsprogram – Degree Programme
Faculty of Biological and Environmental Sciences	Environmental Change and Global Sustainability

Tekijä - Författare – Author

Milla Suomalainen

Työn nimi - Arbetets titel –Title

Services in changing conditions: heatwaves in the context of municipal home care in Helsinki

Oppiaine/Opintosuunta – Läroämne/Studieinriktning – Subject/Study track

Global Sustainability

Työn laji/ Ohjaaja - Arbetets art/Handledare - Level/Instructor	Aika - Datum - Month and year	Sivumäärä - Sidoantal - Number of pages
Master's thesis / Eva Heiskanen	May 2021	49 pp. + 4 appendices

Tiivistelmä - Referat - Abstract

Climate change is expected to increase the frequency and intensity of heatwaves in Finland. Heatwaves increase morbidity and mortality, especially among the elderly and chronically ill. Home care services are in an important role supporting the functioning ability and quality of life among populations vulnerable to heat. This study presents a qualitative empirical case study to understand heatwave adaptation in municipal home care services in Helsinki. The purpose of this study is to explore, describe and analyse the effects of the 2018 heatwave in the context of home care services, and the services' capacity to adapt to heat. The data was collected by conducting semi-structured interviews with home care workers both on the operational and strategical levels. Theoretical frameworks regarding extreme heat vulnerability and local adaptive practices were used to support the analysis.

The results suggest that heatwaves have caused challenges for both workers and customers. While the working ability of home care staff may be reduced due to thermal stress, the customers' reduced functioning ability may simultaneously increase the need for care. Some workers had experienced fatigue, and customers were described having typical heat exhaustion symptoms. Workers adaptive practices were mostly reactive responses aimed at reducing the vulnerability of customers to heat. Interviewees described having taken preventive measures to limit customers' exposure to heat and prevent adverse heat-related health outcomes by monitoring customers' hydration more carefully. No long-term preparedness measures were identified on the strategical level. The city had supported workers by offering mineral drink bottles and providing instructions for coping in hot weather. In conclusion, workers have an active role in adaptation, but it might be limited by their own thermal stress, customers' different health conditions and resources, as well as service-level stressors such as lack of staff.

Because heatwaves are expected to increase in the future, home care services' preparedness to heatwaves might need to be improved. It would be important to consider adaptation needs of both workers and customers as they can be interrelated in the sense, that care is dependent on workers ability to function. In a wider societal framework, the adaptive capacity of home care should be secured through providing sufficient resources for these services. The latter is even more important in the light of future trends regarding the aging of population, increase in need for home-based services and decrease in workforce availability. More research is required on the effects of heatwaves on the most vulnerable populations, what adaptation needs there might be as well as how this relates to service provision.

Avainsanat – Nyckelord

kunnallinen kotihoito, hellehaavoittuvuus, paikallisten toimijoiden sopeutuminen, ilmastonmuutos

Keywords

municipal home care services, heatwave vulnerability, local adaptation responses, climate change

Säilytyspaikka - Förvaringsställe - Where deposited

Helsingin yliopiston kirjasto, Viikki

Muita tietoja - Övriga uppgifter - Additional information

UNIVERSITY OF HELSINKI

Tiedekunta - Fakultet - Faculty	Koulutusohjelma - Utbildningsprogram – Degree Programme
Bio- ja ympäristötieteellinen tiedekunta	Ympäristömuutos ja globaali kestävyys

Tekijä - Författare – Author

Milla Suomalainen

Työn nimi - Arbetets titel –Title

Palvelut muuttuvissa oloissa: helteet Helsingin kaupungin kotihoidon kontekstissa

Oppiaine/Opintosuunta – Läroämne/Studieinriktning – Subject/Study track

Globaali kestävyys

Työn laji/ Ohjaaja - Arbetets art/Handledare - Level/Instructor	Aika - Datum - Month and year	Sivumäärä - Sidoantal - Number of pages
Maisterintutkielma / Eva Heiskanen	Toukokuu 2021	49 s. + 4 liitettä

Tiivistelmä - Referat - Abstract

Ilmastonmuutoksen ennustetaan lisäävän helteiden esiintyvyyttä ja voimakkuutta Suomessa. Helteet lisäävät sairastavuutta sekä kuolleisuutta erityisesti ikäihmisten ja pitkäaikaissairaiden keskuudessa. Kotihoidolla on tärkeä rooli helteille haavoittuvien ihmisryhmien toimintakyvyn ja elämänlaadun tukemisessa. Tämän laadullisen, empiirisen tapaustutkimuksen tarkoituksena oli kuvailla ja analysoida Helsingin kaupungin kotihoidon palveluiden helteisiin sopeutumista. Tutkimus toteutettiin haastattelemalla kotihoidon työntekijöitä ja esihenkilöitä heidän kokemuksistaan vuoden 2018 hellejaksosta, sen aiheuttamista haasteista palveluille, sekä niistä keinoista, joilla näihin haasteisiin sopeuduttiin. Analyysin tukena käytettiin haavoittuvuuden sekä paikallisen sopeutumiskyvyn teoreettisia viitekehyksiä.

Tulokset osoittavat, että helteet ovat jo aiheuttaneet haasteita sekä kotihoidon työntekijöille että asiakkaille. Samalla kun työntekijöiden työkyky voi alentua, asiakkaiden toimintakyvyn heikentyminen voi kuitenkin lisätä hoivan tarvetta. Työntekijät olivat kokeneet helteiden lisäävän uupumusta, ja myös asiakkaiden kuvattiin kokeneen tyypillisiä helleuupumuksen oireita. Työntekijöiden sopeutumiskeinojen tavoitteena oli vähentää asiakkaiden haavoittuvuutta ja ne olivat pääasiassa reaktiivisia toimia ilmenneeseen hellejaksoon. Haastateltavat kuvasivat pyrkineensä rajoittamaan asiakkaiden altistumista kuumuudelle kodeissaan sekä huolehtimaan heidän nesteytyksestään. Pitkän aikavälin varautumistoimia ei tunnistettu strategisella tasolla. Kaupunki oli tukenut työntekijöitä helteiden aikana tarjoamalla juotavaa sekä ohjeistuksilla koskien työskentelyä helteiden aikana. Työntekijöillä vaikuttaa olevan aktiivinen rooli sopeutumisessa, mutta sitä voivat rajoittaa heidän itse kokemansa helleuupumus, asiakkaiden vaihtelevat tilanteet ja resurssit sekä hoiva-alan työntekijäpula.

Koska helteiden ennustetaan lisääntyvän tulevaisuudessa, helteisiin varautumista olisi hyvä kehittää myös kotihoidossa. Olisi tärkeää ottaa huomioon paitsi asiakkaiden myös työntekijöiden sopeutumistarpeet, sillä hoiva on riippuvaista työntekijöiden hyvästä työkyvystä sääoloista riippumatta. Laajemmassa yhteiskunnallisessa kehyksessä kotihoidon sopeutumiskyky tulisi varmistaa myös tulevaisuudessa turvaamalla kotihoidolle riittävät resurssit. Tämä on erityisen tärkeää siksi, että väestö ikääntyy, ja kotihoidon tarve tulee todennäköisesti lisääntymään tulevaisuudessa. Lisää tutkimusta tarvitaan helteiden vaikutuksista ja niihin liittyvistä sopeutumistarpeista haavoittuvimpien ihmisryhmien keskuudessa, sekä mitä vaatimuksia tämä asettaa sosiaali- ja terveyspalveluiden tuottajille.

Avainsanat – Nyckelord

kunnallinen kotihoito, hellehaavoittuvuus, paikallisten toimijoiden sopeutuminen, ilmastonmuutos

Keywords

municipal home care services, heatwave vulnerability, local adaptation responses, climate change

Säilytyspaikka - Förvaringsställe - Where deposited

Helsinki University Library, Viikki

Muita tietoja - Övriga uppgifter - Additional information

Table of content

1. Introduction

Climate change is seen as one of the biggest current threats to humankind. It is expected to increase the frequency and intensity of extreme weather events, such as heatwaves, which in return will create risks for the functioning of both human and natural systems. The magnitude of these changes depends in part on the success or failure of climate change mitigation. Despite ongoing mitigation efforts, climate continues to warm on a global average of 0.2C per decade because of human activity (Field *et al*. 2014). This means that changes are inevitable, and human systems need to adapt to these on-going and potential changes. Less of the adaptation literature has focused on understanding the 'grassroots' level of adaptation, the impacts felt, and measures taken by ordinary citizens, including those working in public services such as health and social services. These voices need to be heard to complement the expert knowledge on adaptation. Moreover, it is important to study the diversity and sustainability of these local adaptive practices to support local adaptation (Wamsler & Brink 2014a). Studying local level adaptation can pinpoint local adaptation needs and inform more socially justifiable climate adaptation policies.

Heatwaves are among the most dangerous extreme weather events for human health. In addition, they can disrupt the functioning of natural systems, and human systems of non-health domains, such as energy use and provision, water safety, agriculture, transport and built environments (Disher *et al.* 2021). One third of human population already gets exposed to dangerously high temperatures every year (Mora *et al.* 2017). In the U.S., heatwaves are the primary extreme weather event to increase mortality of the population (Luber & McGeehin 2008). A heatwave in Russia in 2010 killed tens of thousands of people, and heatwaves of even stronger magnitude are expected in Europe in the future (Russo, Sillmann & Fischer 2015). Heatwaves in Finland have been linked to significant increases in mortality, especially in the older age groups (Kollanus & Lanki 2014; Näyhä 2005). In the future, very hot summers in Finland might repeat more often than every second year at the end of the century (Jylhä *et al.* 2009). The felt impacts of heatwaves are unevenly distributed; some parts of the populations such as young children, the elderly and chronically ill can be more vulnerable than others (Ikäheimo & Jaakkola 2019).

Urban environments are central locations for heatwave adaptation. The city of Helsinki, as the capital of Finland, hosts the largest population and biggest population density in the country. The city's municipal social services and health care are responsible for the care of some of the most vulnerable populations to heatwaves. This is especially true in the case of elderly services. As a care service provider, Helsinki has important responsibility in securing the safety of service recipients during times of emergency. However, the role of the health care sector in climate change adaptation is currently undefined. This can be partially due to the complex and decentralised nature of the Finnish

health system. (Mäkinen *et al.* 2019.) Sector-specific guidelines for climate change adaptation are only just being developed (Ministry of Social Affairs and Health 2021). Clear national or regional guidelines to adaptation are often crucial for local authorities and actors (Tuusa *et al.* 2013; Mayer *et al.* 2020; Stern 2008). Preparedness is evaluated as critical in the case of heatwaves since mortality increases quickly after rising temperatures (Public Health England 2013). It is argued that awareness of and preparedness to heatwaves is insufficient in elderly centres and home care in Finland (Ung-Lanki *et al.* 2017; Mayer *et al.* 2020). Although climate change adaptation is seen primarily an issue of governance (Juhola 2013), and city governments among the key actors (Wamsler 2014), oftentimes it comes down to local level citizens and workers to implement adaptation in their daily activities. As it is not realistic to expect any quick changes in the built structure of the city to be better adapted to heat, many of its' residents will remain potentially exposed to heatwaves in their homes. In these cases, home-based services can help more vulnerable citizens to adapt.

In Helsinki, around 34% of the population aged 85 or more receive regular home care services (Finnish Institute for Health and Welfare 2019). Home care customers can be more vulnerable to heat due to age and chronic illnesses, low income, poor housing conditions and lack of social networks other than formal care. In addition, home care workers themselves are at risk of heat stress due to the nature of the work which potentially exposes workers to heat both outside and in customers' homes, and because the work can be physically demanding. Home care services are experiencing other pressures as well, as the care sector is having difficulties in recruiting staff, which can lead to limited local workforce capacity (Kehusmaa *et al.* 2018). As the population ages and the need for home care is expected to increase, how can these services cope with increasing heat risks in the future? As people in a vulnerable position can be more dependent on these institutions supporting them (Mayer *et al.* 2020), this furthermore emphasizes the need to understand the role of services in supporting home care customers adaptation to heat.

This thesis presents an empirical qualitative case study on how heatwaves have been experienced in municipal home care services in Helsinki. Thesis was done as a commission work for the city of Helsinki's Social Services and Health Care division. Rather than focusing on expert opinions, I focus on the experiences of the frontline workers themselves, who might be an important source of knowledge regarding social vulnerability (Mees, Driessen & Runhaar 2015). The goal is to explore and describe what kinds of effects the previous heatwave in 2018 had in terms of customers, staff and services, as well as what adaptation measures were taken, and the experiences in implementing those measures. The roles and responsibilities of different actors in addition to services, mainly informal carers (families) and third sector in the adaptation will be explored as they might be important in terms of resilience and adaptive capacity (Anderson *et al.* 2020). Taken measures will be analysed in terms of their effectiveness, diversity and sustainability, and the preparedness level of home care services to heat will be evaluated.

I will ask:

- How have heatwaves manifested in the context of home care?
- What kinds of challenges do heatwaves pose to the provision of home care services, and what solutions do home care workers have for addressing such challenges?
- How do home care workers understand their own role in adapting to heatwaves, and how does this role relate to customers' and their families' roles?

The starting hypothesis is, that home care services as a community resource can increase adaptive capacity of home care customers.

2. Background

2.1. Heatwaves in Finland

Heatwaves have no universal definitions, because the felt impacts of heat are relative to local climates. This is due to populations' acclimatization to their local climates, both within physiological as well as cultural and behavioural terms. (Kovats & Hajat 2008.) The common understanding about heatwaves relates to risks of thermal stress both on people and the environment (Holbrook *et al.* 2020). Heatwaves can be defined as periods of unusually hot weather that last at least 2-3 days and cause clear impact on human and natural systems (McGregor *et al.* 2015). According to the definition of the Finnish Meteorological Institute (2021) a heat day occurs in Finland when the maximum daily temperature exceeds 25°C. There are on average 5-10 of such days annually on the coastal areas, where Helsinki is also located. Exceptional heatwaves (lasting at least 3 weeks) have occurred more frequently during the last two decades; after 1961 they have occurred in 2003, 2010, 2014 and 2018, most commonly around July. (Finnish Meteorological Institute 2021.) In the future temperatures could get 1 to 5 degrees warmer than the average during the summer (Jylhä *et al.* 2009).

2.2. Vulnerability to heat

Heat increases both morbidity and mortality, especially among the elderly population (Ikäheimo & Jaakkola 2019). Risks in Finland increase significantly when the mean daily temperature exceeds 20 degrees Celsius (Ruuhela *et al.* 2017; Pilli-Sihvola *et al.* 2018). A heat warning is issued by the Finnish Meteorological Institute when the daily average air temperature exceeds 20 degrees (Finnish Meteorological Institute 2021). Heatwaves are especially harmful for populations aged 75 and older, as they strongly increase mortality within this age group. During heatwaves of 2003 and 2010 mortality in Finland increased on average 14 – 21 %, especially in the over 75 age group and in health care facilities. The findings are similar to results from other European studies. (Kollanus & Lanki 2014.) Mortality-inducing events of heat in Finland have also occurred at least in 1973, 1978, 1988,

1995 and 1997 (Näyhä 2005). Results indicate that mortality increases already during short events of heat and in lower temperatures (Basu 2009).

A prolonged period of heat causes physiological changes in the body, resulting in direct or indirect effects in functioning abilities and health. This can cause problems especially for the elderly, chronically ill or otherwise vulnerable people such as young children. (Ikäheimo & Jaakkola 2019.) High body temperature exacerbates chronic conditions and can be very harmful to health; leading eventually to damage or failure of important organs (Davies & Maconochie 2009; Garcia-Trabanino *et al.* 2015). Depression, cardiovascular and cerebrovascular conditions and diabetes can be among conditions that increase vulnerability to extreme heat (Kovats & Hajat 2008). Respiratory and cardiovascular diseases are important contributors to heat-related morbidity and mortality (Public Health England 2013). In Finland, cardiovascular diseases are the leading cause of death for both men and women, and hence a major reason for ill health. In addition, diabetes and depression are common causes of poor health, affecting people with lower education and lower income levels disproportionately. (Organization for Economic Co-operation and Development 2017.) The mechanisms of heat to health are multiple; illnesses may compromise thermoregulation, but they can also affect mobility, awareness and behaviour. Common medications may also compromise thermoregulation, and hence make people more sensitive to heat. (Kovats & Hajat 2008.) For elderly people, heat simultaneously decreases feelings of thirst and the body's ability to endure hot temperature (Ikäheimo & Jaakkola 2019). Within the healthy adult population, adverse effects of heatwaves are related to reduced labour capacity; evidence points towards heatwaves reducing working ability also in Finland (Rissanen 2020) and Sweden (Malmquist *et al.* 2021). Heatwaves can also increase the need for emergency and hospital care (Pilli-Sihvola *et al.* 2018).

Vulnerability can also be socially determined. In a sociological study of a 1995 heatwave in Chicago Klinenberg (1999) demonstrates how the mortality was a result of a combination of social factors such as unequal housing conditions and neighbourhood characteristics as well as weak government response and emphasis on individual responsibility to survive through heat. People with low income, low education, unemployment and increased social isolation are identified as potentially more vulnerable to climate change (Carter *et al.* 2016), including extreme weather events such as heatwaves (O'Neill, Zanobetti & Schwartz 2003). In addition, gender might also play a role in vulnerability to heat, as women have been recognized as more vulnerable both in Finland and other European countries (Kovats & Hajat 2008; Ikäheimo & Jaakkola 2019). Potential social, physiological, and even psychological impacts of heatwaves include social isolation, reduced mobility, stress on relationships and irritability, increase in domestic and street violence, poor sleep, tiredness and lethargy and energy stress (Bolitho & Miller 2017).

2.3. Urban living exposes citizens to higher temperatures

Urban environments can both intensify existing hazards and create new ones (Wamsler 2014). Cities are known to have higher temperatures than the surrounding areas due to the urban heat island effect (UHI); The primary contributor is that the 'fabric' of the city such as pavements and buildings absorb more heat, secondary being the waste heat resulting from energy usage. Due to UHI effect mortality caused by heat-stress can also be higher in urban areas. This phenomenon is said to be stronger in northern European cities. (European Environment Agency 2018.) Results from Turku indicate for the city centre to act as a heating centre during summer (Suomi & Käyhkö 2012). There is very little knowledge on spatial distribution of heat in Helsinki (Kazmierczak 2015). However, a master's thesis study done in Helsinki (Drebs 2011) suggests that the city centre is warmer than its immediate surroundings. Centres in suburban areas create their own heat islands; most strongly affected seem to be Vuosaari, Malmi, Itäkeskus, Herttoniemenranta and Pitäjänmäki (Drebs 2011). Vuosaari and Malmi belong to those with largest numbers of elderly people living in single households (City of Helsinki 2020). Single buildings also create their own UHI effect (Drebs 2011). Ruuhela *et al.* (2021) have compared mortality to heatwaves in Helsinki and the surrounding regions and found that mortality can be 2.5 times higher in Helsinki than in surrounding regions. They also assessed the effect of UHI and concluded that it might contribute to some of this effect. This emphasizes the need to adapt to heatwaves within urban settings.

In Finland harmful heat exposure most commonly occurs indoors (Hassi *et al.* 2011). Homes can become 'prisons' in cases where a person has no means of escaping the heat. The form of housing, location of the home in an apartment building and in the city, quality of housing and management of the building can all affect how people are exposed to environmental stressors inside their homes. Furthermore, the ability to maintain comfortable indoor temperatures is affected by factors such as the ability to afford air conditioning or knowledge about ways to utilize passive cooling techniques. It is estimated that 20-30% of households in Finland are unable to keep their homes cool during the summer (European Environment Agency 2018), although the percentage in cities such as Helsinki is not specified. Northern countries are traditionally more adapted to cold environments, and hence the building structure might not be so well adapted to heat. Lack of natural or artificial shading and thin ceilings increase heat-transfer to the building. Top *and* ground floor apartments in multistorey buildings are more affected by heat. (Liu *et al.* 2017; Koppe *et al*. 2004; Wamsler 2014.) Small apartments with no air conditioning and with big windows facing south or west can be especially affected. Cooling systems in apartment buildings in Helsinki are rare. (Pilli-Sihvola *et al.* 2018.) Heat health risks become especially dangerous when heatwaves cause buildings to heat so that the temperatures will not go down even during nights, and heat stress becomes continuous (Meriläinen 2020).

Socio-spatial mapping tools are used to characterize vulnerability of urban populations to climate change. Such tools have been developed within the Nordic context as well (e.g. Carter *et al.* 2016). An assessment conducted by Kazmierczak (2015) for Helsinki region Environmental Services indicates that while many areas in Helsinki are at risk of enhanced exposure to heat, residents generally have good adaptive capacity. According to Kazmierczak (2015), social vulnerability to heat tends to be emphasized in eastern Helsinki. While important, these assessments might lack in empirical evidence backing up the assumptions. Moreover, Wilhelmi and Hayden (2010) state that spatial assessments do not necessarily provide enough knowledge to back up decisions and actions regarding vulnerability interventions. For example, the availability of or access to care cannot simply be taken as a factor that will decrease vulnerability to heat, as institutional care facilities have actually been a risk factor in heat-related mortality in certain contexts (Kollanus & Lanki 2014), and as care services are facing other stressors such as limited workforce capacity (Kehusmaa *et al.* 2018), which can very well affect the quality and provision of care. Engle (2011) states that adaptive capacity changes between contexts and is difficult to generalize. Qualitative research about local adaptive capacities is needed (Wamsler 2014; Wilhelmi & Hayden 2010). As the role of health care provision is seen as important in shaping the adaptive capacity of many vulnerable populations, this context needs to be evaluated in more depth.

3. Conceptualizing adaptation to heat risk in home care

In the following I will present the main theoretical underpinnings of this thesis. The results will be analysed with the help of the extreme heat vulnerability framework by Wilhelmi and Hayden (2010), in which the factors affecting households' vulnerability are outlined. Same framework has been used in similar studies previously (e.g. Malmquist *et al.* 2021). To understand the effectiveness of taken measures the prevention -framework by Ebi and Semenza (2008) will be used as a corresponding concept to adaptation. Furthermore, their diversity and sustainability will be evaluated with the help of the concept adaptive practice by Wamsler (2014) and Wamsler and Brink (2014a). The usefulness of these frameworks within this thesis and for future studies is considered in Chapter 5.

3.1. Understanding heat risk and vulnerability to extreme heat

The concept of a 'disaster risk' refers to potential losses a community or a society might face in the future (United Nations International Strategy for Disaster Reduction 2009). 'Heat risk', then, is the potential for losses caused by heat. Such losses could be increased deaths, morbidity and disrupted livelihoods or services. A heat risk can have impacts both on the individual level and more systemic levels. Therefore, a heat risk does not concern only health impacts, but impacts to service provision, which can have indirect health impacts. The potential losses caused by heat are highly contextual

because they are determined by local vulnerability conditions. In the following I will describe those conditions in more detail.

Vulnerability is a concept that defines factors exposing individuals or households to adverse outcomes of hazards, such as heatwaves (Wamsler & Brink 2014a). Vulnerability is not a static category; it changes over time and across regions (Cutter & Finch 2008). In climate adaptation literature, vulnerability is typically divided in three categories: exposure, sensitivity and adaptive capacity (Carter *et al.* 2016). Same categorization is used in the extreme heat vulnerability framework (Figure 1) developed by Wilhelmi and Hayden (2010), which describes households' susceptibility to be harmfully affected by heat. The framework was developed specifically for addressing a gap in research concerning local level adaptive capacities (Wilhelmi & Hayden 2010). It will be used to conceptualize vulnerability in the home care context, and to locate the potential role of home care services in reducing the vulnerability of customers to heat.

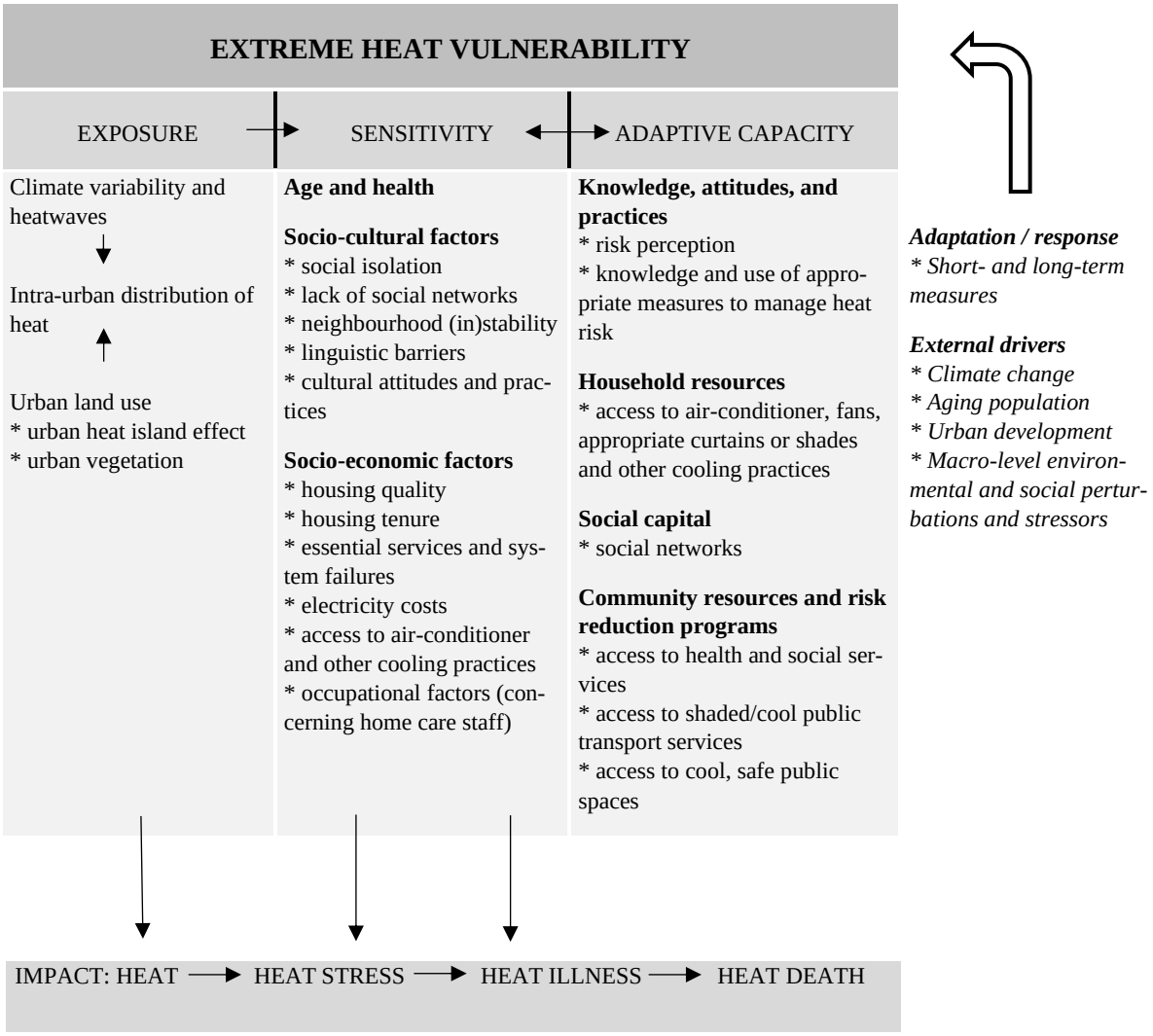
Exposure to heat is rather self-explanatory. It is affected both by climate variability and urban land use, which both contribute to intra-urban distribution of heat (Wilhelmi & Hayden 2010). As has been discussed earlier, the UHI effect might intensify urban heatwaves and cause more deaths and morbidity to urban citizens (Ruuhela *et al.* 2021). Within the context of Helsinki, the city centre and suburban areas create their own heat island effects (Drebs 2011). Exposure can create a heat risk for both home care workers and customers. Exposure affects people in different ways according to their sensitivity and adaptive capacity (Wilhelmi & Hayden 2010).

Sensitivity refers to the ability of a system, population or individual to *'absorb impacts without suffering long-term harm'* (Wilhelmi & Hayden 2010, p. 3). As was discussed earlier, heat-specific sensitivities include young or old age and certain health conditions such as cardiovascular diseases (Ikäheimo & Jaakkola 2019; Kovats & Hajat 2008). In addition, certain socio-cultural and socio-economic factors can increase sensitivity to heat. These include among others housing quality and housing tenure, electricity costs, access to cooling practices, social isolation, and social networks as well as cultural attitudes and practices. (Wilhelmi & Hayden 2010; Miller 2014.) Home care customers might be more sensitive to heat due to high age and chronic illnesses, but also potentially due to poor housing conditions, limited access to cooling technology and other cooling practices, loneliness, and lack of supporting networks other than formal care. However, sensitivity and exposure can both be managed through adaptive capacities (Wilhelmi & Hayden 2010).

Adaptive capacity refers to the potential of the household / individual or even system to adjust features and behaviour *'so as to better cope with existing and anticipated stresses'* (Wilhelmi & Hayden 2010, p. 3). Therefore, it acts as the 'vessel' through which to adapt to heat. Factors that can build adaptive capacity include knowledge, attitudes and practices that support adaptation to heat; household resources such as income; social capital such as good relationships with families and

neighbours; community resources such as care services as well as risk reduction programs (Wilhelmi & Hayden 2010). For the purposes of this study, home care services are understood as a community resource that can potentially increase the adaptive capacity of households. Similar assumptions have been made in previous studies regarding vulnerability of the elderly to extreme temperatures (see Carter *et al.* 2016). This study focuses on the practices that shape adaptive capacity and the vulnerability outcome of heatwaves.

Figure 1 Extreme heat vulnerability in home care (adapted from Wilhelmi & Hayden 2010; specific information added from Miller 2014; Juhola *et al.* 2020; O'Brien & Wolf 2010; Kovats & Hajat 2008)



Adaptive capacity needs to be separated from the concept of adaptation. As has been discussed, adaptive capacity does not necessarily translate to action, as it merely depicts the potential for adaptation (Barnett, Gardner & Meyers 2015). This also means that there can be *unused* capacities (Wamsler 2014). Adaptation refers to actual measures taken to manage, in this case, heat risk. In the IPCC Fifth Assessment Report (Field *et al.* 2014) adaptation is understood as preparation for or

reaction to actual or expected changes. Adaptation is often divided as being either reactive or anticipatory, and this categorization has been used for example to evaluate different actors' preparedness level to climate change (see Juhola 2013). Adaptation can have either positive or negative consequences (Wamsler 2014), while adaptive capacity is usually seen as a desirable and positive attribute of a system (Engle 2011). Human beings are adaptable creatures, and societies have and continue to adapt to changes in their environments. However, the rate at which these changes are happening due to climate change can cause further demands on populations' and individuals' adaptive capacities. (Field *et al.* 2014.)

Vulnerability is also affected by external drivers, such as climate and population changes, urban development and macro-level environmental and social perturbations and stressors (Wilhelmi & Hayden 2010). In the context of home care, population ages and the need for home care is expected to increase in the future (Kehusmaa *et al.* 2018). This is most likely also affected by policies favouring home care instead of institutional care or supported housing. Simultaneously there are difficulties in recruiting staff in the care sector (Kehusmaa *et al.* 2018), and pressures for policymakers to improve conditions for elderly care through changes in legislation. These are the kinds of external drivers that might be reflected on the household level vulnerability if access to services is negatively affected.

The actual adaptation or response on the individual, community, national and even global levels can have implications for household vulnerability (Wilhelmi & Hayden 2010). Adaptation can be short- or long-term (Juhola *et al.* 2020) and include changes in for example urban design and land use, adoption of targeted warnings for different risk groups, implementation of community-based programs and public health education and outreach as well as public assistance (Wilhelmi & Hayden 2010). There are many institutions in Finland that provide information for individual households, workplaces and even health care facilities about how to prevent heat health risks, such as the Finnish Institute of Health and Welfare and the Finnish Institute of Occupational Health. In addition, the Finnish Meteorological Institute issues a heat warning for the public when extreme heat is predicted. However, as mentioned, the health sector is only beginning to develop sector-specific adaptation guidelines (see Ministry of Social Affairs and Health 2021).

In conclusion, due to the differing patterns of exposure, sensitivity and adaptive capacity, citizens have different vulnerabilities to heat.

3.2. The role of frontline workers in managing heat risk

The purpose of home care is to increase the functioning capacity and wellbeing of the customers. Therefore, it can be argued that the main purpose is to decrease vulnerability of customers not only to heat but to other stressors that might threaten individuals' health and safety. In practice, the work

in home care involves caring for the basic needs of customers, such as food and hygiene, and helping in daily activities. Work in home care is multiprofessional, and involves nurses', practical nurses', and other home help workers' as well as doctors' and other care professionals' input. Frontline workers within this study refer to nurses and practical nurses involved in the daily care of customers, as well as home care instructors who are the immediate team supervisors of home care staff. In practice, home care workers can treat heat stress and heat illnesses, but also manage customers' exposure to heat in their own homes as well as their access to different cooling practices.

The role of nurses and social networks in elderly peoples' resilience to heat is critical, as highlighted in expert interviews among general practitioners (Herrmann & Sauerborn 2018). The role can be very important especially if customers are socially isolated and highly dependent on services for care and assistance. Barnett, Gardner and Meyers (2015) argue that community-based health and social service organizations have an in-built capacity to adapt to climate change. It would seem that reducing the vulnerability of customers is the focus of work in home care, and the work requires constant adaptability from workers. Neal (1999) has suggested that adaptation is a core category of home care nursing practices, as nurses need to adapt to constantly changing environments and needs and apply their know-how often creatively. In social systems the nature of adaptation is usually intentional (Adger *et al.* 2009), which means that it can be managed. From the health -perspective, the goal of adaptation is defined as managing health-related climate risks (World Health Organization 2018). In doing so, both preparedness and acute prevention are needed (Public Health England 2013).

In a report by the Finnish Climate Change Panel regarding climate change adaptation policies (Juhola *et al.* 2020), heat health risk prevention is divided into short-term and long-term measures. Short term measures can also be called 'coping' measures as distinct from adaptation (Barnett, Gardner & Meyers 2015). Wamsler and Brink (2014b) argue however, that the there is a significant overlap between 'coping' and 'adaptation', so within this study they will be used as synonyms. The latter include mapping risks and vulnerabilities, taking heat into account in urban planning, developing societal preparation and raising people's overall awareness about heat risks and adequate preventive measures. Short-term adaptation is understood as acute health risk prevention and belongs to the domain of health care professionals. (Juhola *et al.* 2020.) Prevention is therefore seen as an appropriate concept to characterize frontline workers adaptation in public health, as also noted by Ebi and Semenza (2008). Furthermore, it can be classified into primary, secondary, and tertiary prevention. Primary prevention reduces exposure (to heat), secondary *'aims to prevent the onset of adverse health outcomes'*, and tertiary '*consists of measures (often treatment) to reduce long-term impairment and disability and to minimize suffering caused by existing disease'*. (Ebi & Semenza 2008, p. 502.) Measures aimed at limiting exposure are most important in preventing heat stress and heat-related illness (World Health Organization 2011).

In the previously presented framework regarding extreme heat vulnerability in home care context, access to health services was, in theory, seen as building households' adaptive capacity. At the same time practices to manage heat risk were seen as adaptive capacities that can potentially make households less susceptible to heat risks. In conclusion, frontline workers' role in managing heat risk is in preventing exposure, adverse health effects and treating heat-related illnesses. This might require a multitude of practices and a lot of practical wisdom, understanding of heat risk in home care context, resilience and even creativity in navigating customers' differing adaptation situations meanwhile also managing ones' own potential heat stress.

3.3. Local coping/adaptive practices

'Coping/adaptive practices' refer to those local measures taken to prevent hazard risk (in this case, heat risk) (Wamsler 2014; Wamsler & Brink 2014a). Local within this study refers to measures taken by home care workers. The framework was created to systematically analyse people's adaptive capacities (Wamsler 2014) and is presented in Table 1. Although the emphasis of this work is in home care services adaptive capacity, the nature of work in home care, which takes place in customers' homes, and the adaptive measures, which are performed by home care staff as individuals, indicates that this kind of framework might be useful. Adaptive practices might also be a more realistic reflection of local capacities than for example mere knowledge and attitudes, as they represent the actual measures taken to adapt to heat.

Practices can be assessed from six different perspectives: objective, thematic focus, hazard-focus, underlying pattern of social behaviour, timing and awareness and support. The objectives of adaptive practices are separated in four main categories: hazard reduction and avoidance, vulnerability reduction, response preparedness and ad hoc response as well as recovery preparedness and ad hoc recovery. (Wamsler 2014; Wamsler & Brink 2014a.) For the purposes of this study, vulnerability reduction is understood as any measures related to decreasing the exposure and sensitivity and increasing the adaptive capacity within a household level. Practices can have different thematic foci: physical, environmental, socio-cultural, economic, political and institutional (Wamsler 2014; Wamsler & Brink 2014a). Heatwave adaptation in home care is most likely focused on physical measures such as caring for heat stress and heat illness. Regarding the hazard-focus of a given strategy, Wamsler (2014) states that non-hazard specific measures can potentially help in more than one hazard context. Such measures in the heatwave context would be for example measures to improve low-income households' financial resources. Practices can have differing patterns of social behaviour, such as individualistic self-help measures or fatalistic undertones of choosing to be completely passive. Practices can be timed differently depending on the preparedness level, be planned or ad hoc and intentional or unintentional. (Wamsler 2014; Wamsler & Brink 2014a.)

It is important to note that Wamsler (2014) emphasizes considering the effectiveness of coping measures as part of a sustainable coping/adaptation system. This refers to a system that helps individuals and communities to reduce their risk and maintain capacities while allowing future generations the ability to satisfy their needs (Wamsler 2014).

Table 1 Framework for analysing local coping/adaptive practices (adapted from Wamsler 2014; Wamsler & Brink 2014a)

Analysis categories of a given adaptive practice	*Dimensions*	*Further information*
The objective	Hazard reduction and avoidance Vulnerability reduction Response preparedness Ad hoc response Recovery preparedness ('self-insurance') Ad hoc recovery	The same measure can have multiple objectives, as for example hazard reduction measures such as reducing the heat island effect can potentially reduce citizens vulnerability to heat.
Thematic focus	Physical Environmental Socio-cultural Economic Political Institutional	It appears most hazard-specific measures are physical or environmental, while non-hazard specific tend to be more socially and economically oriented.
Hazard focus	Hazard-specific Non-hazard specific	Non-hazard specific measures can potentially help in multiple hazard contexts
Underlying patterns of social behaviour	Individualistic Communitarian Hierarchical Fatalistic	'self-help' helping others relying on institutions pessimistic / 'non-strategy'
Timing and awareness	Well in advance / shortly before Planned / ad hoc Intentional / unintentional	
Support	Supported / not supported by any governmental authorities or aid organizations	

Wamsler (2014) continues that a sustainable coping/adaptive system needs to be considered in terms of its flexibility and inclusiveness. Flexibility refers both to the number of measures used to address a risk as well as the diversity of those measures. This suggests that a system is more sustainable if the measures have diverse thematic focus and hazard focus as well as underlying patterns of social behaviour. Inclusiveness means that a sustainable system has measures addressing all objectives outlined in the framework. (Wamsler 2014.) Within this systemic perspective, private and public actors can work together to increase the resilience of the systemic whole, and make sure the actions by the public can be helpful for vulnerable populations. Ideally, in a coordinated adaptation situation, the

mutually beneficial responsibilities and roles have been clearly determined. (Wamsler & Brink 2014b.)

3.4. Previous studies on local level adaptation to heat and examples from practice

As has been argued, there is a lot of information about what makes individuals more vulnerable to heat in terms of age, health and even socio-economic and socio-cultural factors such as the level of social isolation and housing quality. However, less is known about local/individual level adaptation (Wamsler 2014; Wilhelmi & Hayden 2010). To my knowledge there are no studies concerning adaptation in the home care context, except for the study regarding heatwave preparedness in institutional care and home care by Ung-Lanki *et al.* (2017).

The heatwave adaptation literature is rather dispersed and scarce. Adaptation to heatwaves have been studied for example from the perspectives of low-income populations (Zografos, Anguelovski & Grigorova 2016; Matmir *et al.* 2017), individual behaviour (Esplin *et al.* 2019), risk perceptions of the elderly and other at-risk populations (Frykman 2019; Liu *et al*. 2013), social capital (Wolf *et al.* 2010) and preparedness level and practices within different institutions such as health care and education (Ibrahim *et al.* 2012; Ung-Lanki *et al.* 2017; Yang *et al.* 2020; Malmquist *et al.* 2021). Many of these studies have been conducted within traditionally warmer countries, although there are some recent examples from Sweden.

Values and risk perception are seen as important factors in contributing to protective behaviours against heat (O'Brien & Wolf 2010). Any well-planned measures on higher levels will fail if individuals, including health care staff, do not see heat risks as personal or relevant risks to address. Mees, Driessen and Runhaar (2015) have evaluated, that in the Netherlands citizens' awareness of heat risk is low. A master's thesis by Frykman (2019) suggests that the elderly in a Swedish municipality did not see heatwaves as a risk to themselves, although a recent heatwave had resulted in behavioural changes such as changes in food and drink intake, clothing and finding a cool environment. Within the Finnish context Ung-Lanki *et al.* (2017) recognized gaps in risk perception and preparedness to heatwaves within Finnish care facilities and home care services. On the other hand, as Liu *et al.* (2013) point out, high risk perception might not automatically turn into adaptive behaviour. Moreover, awareness does not necessarily mean that heat risk is perceived as a personal threat (Martinez *et al.* 2019). This emphasizes the importance of other factors such as targeted information campaigns, knowledge about suitable protective practices against heat, the resources available and the help provided through relationships with other people.

Other factors such as the frequency of heatwaves and level of income have been studied in relation to heatwave adaptation. Previous experiences of heat might encourage protective action against extreme heat in the future both on the individual (Esplin *et al.* 2019) and organizational (Mallon &

Hamilton 2015) levels. However, there may be significant barriers to adaptation even if people and communities are in principle willing to adapt. In low-income populations exposure to heat *did not* increase adaptive capacity on the community level (Zografos, Anguelovski & Grigorova 2016), although low-income populations might be more worried and feel less prepared for heatwaves (Matmir *et al.* 2017). Weber (2006 as cited in Jonsson & Lundgren 2015) has stated that worry might be a driver for actions against climate risks.

The existence of social networks is seen as a potentially protective factor against heat. Social contacts might protect for example from heat wave mortality (Naughton *et al.* 2002). Wistow *et al.* (2015) note the importance of networks of care, stating that formal actors such as policy makers and emergency planners need to help local stakeholders to form and strengthen connections in both formal and informal contexts, and develop preparedness. However, as Wolf *et al.* (2010) suggest, social capital does not automatically translate into adaptive capacity; on the contrary, shared narratives within strong bonding networks (close relationships) might also reduce risk perception.

Jonsson and Lundgren (2015) noted that among Swedish strategical and operational staff (whose work concern heatwave adaptation), as well as among vulnerable people themselves, there exists an abundance of local knowledge related to vulnerability drivers, as well as ideas about reactive and proactive measures to prevent heat stress. On the other hand, Ibrahim *et al.* (2012, p. 297) investigated health professionals' awareness, knowledge and practices during heatwaves in Australia, and found significant gaps in knowledge regarding *'thermoregulation, risk factors, heat-related illness, and the use of fans'*. Taken measures were mainly reactive and opportunistic (Ibrahim *et al.* 2012). Yang *et al.* (2020) found out that primary health care professionals in China find lack of funding and limited local workforce capacity as important barriers for adaptation to heatwaves. Most professionals felt a need to improve capacities both on individual and institutional levels (Yang *et al.* 2020). In a recent study concerning heatwave adaptation in Swedish preschools, Malmquist *et al.* (2021) concluded that children are exposed to a double sensitivity to heat due to teachers' exposure to heat stress. Preschool staff and parents interviewed for the study felt that the effects of previous heatwaves had been severe enough, and preparedness level in preschools is insufficient (Malmquist *et al*. 2021).

Based on the above it seems as though informing the public about risks of heat alone is not enough to increase action against heat, and lack of resources and unsupportive social networks might increase local vulnerability to heat. Therefore, it can be argued that when designing heatwave adaptation measures, simple information campaigns and early warnings programs are not enough to address the differential vulnerabilities of citizens and communities. Ebi (2009) states that these measures do not necessarily consider the underlying reasons for vulnerability, such as low income and poor social networks.

Zaidi and Pelling (2015, p. 137) have stated that '*the creation of a formal emergency plan to deal with extreme weather events can greatly improve the risk management capacity of a particular society'*. Although only 12 European countries had heatwave early warning systems in 2011 (Lowe, Ebi & Forsberg 2011), by 2018 a heat health action plan had been adopted by 35 EU member states (Martinez *et al.* 2019). Finland is yet to adopt such a plan, although an early warning system is offered by the Finnish Meteorological Institute for the public. Examples of ways to deal with heatwaves can be found from big cities such as Paris, Philadelphia, and Toronto. In Paris, vulnerable (elderly) citizens are contacted regularly during a heatwave based on information collected to a vulnerability -database. In Philadelphia, a heat line, a nursing team and volunteers are prepared to respond to vulnerable citizens' needs. A heat line is also used in Toronto. Many local authorities have also assigned public cooling centres. (Mees, Driessen & Runhaar 2015.) Evidence is unclear whether heat action plans, including targeted warnings and other preventive measures, are effective in reducing heat-related morbidity and mortality; results differ within national contexts and between different population groups (Martinez *et al.* 2019). Wamsler (2014) argues that information about appropriate adaptation measures to hazards rarely reach critical populations. There is little knowledge about the effectiveness of programs targeted at reducing heat risks among the elderly as was noted by Vu, Rutherford and Phung (2019).

3.5. Research gap and justification

Researchers agree on the importance of local-level capacities to climate change adaptation. However, very little is known about adaptive capacities, practices and behaviour of citizens, and a need for more research on this topic has been identified globally (Wamsler & Brink 2014b). Wilhelmi and Hayden (2010, p. 2) stress the importance of understanding adaptive capacity at the local level as *'critical to understanding the vulnerability of urban population*'. Furthermore, they emphasize understanding knowledge, attitudes and practices related to heat as necessary to complement quantitative aggregate demographic data about vulnerability to heat. To my knowledge there is no empirical qualitative research in Finland or elsewhere about heat-related adaptive practices in home care. More knowledge is needed about health consequences of adaptation measures at community and national levels (Field *et al.* 2014), and adaptation needs of the most vulnerable populations to climate change (Mayer *et al.* 2020). Curtis *et al.* (2017) point out that the role of communities in adapting to extreme weather is important, and there is only little research on the role of professional carers, individuals, and communities in preventing adverse health outcomes of climate change.

While research has not yet paid so much attention to local level practices and capacities, and the role of professional carers in decreasing the vulnerability of people to heatwaves and other extreme events, there is also a gap in policy and practice. It seems as though social impacts of heatwaves have gained less attention than health impacts and critical energy and transport infrastructure both in

policy and in research (Bolitho & Miller 2017). As was mentioned in the introduction, the role of the health care sector in climate adaptation is underdefined. This does not mean that no adaptation responses exist, but little knowledge about these measures and their effectiveness exists. A recent report by the Association of Finnish Municipalities (Jalonen & Antikainen 2020) states that adaptation practice in municipalities has been most active in the technical sector regarding floods and water supply management. In the health sector, the most common practice is related to managing indoor temperatures in care facilities during heatwaves. Although the latter is important given the fact that heat-related mortality has increased most in health care facilities (Kollanus & Lanki 2014), some health care officials have been more worried about home care services in which there are challenges regarding taking care of customers hydration (Rapeli, Mussalo-Rauhamaa & Innola 2016).

The emphasis in the technical approach is problematic from the perspective of home care services, as they are situated in the private sphere of customers, and hence out of reach of these 'property management' practices in heatwave adaptation. In home care services, the adaptation is mediated through the everyday practices of home care workers, home care customers themselves as well as other people and organizations involved in the lives of home care customers. Therefore understanding the role of home care services in decreasing the vulnerability of customers to heat through adaptative measures is important. Moreover, the social dimensions of extreme heat such as access to cooling practices, housing quality and social isolation require more consideration.

4. Materials & Methods

At first, I will justify the case study approach and offer a more detailed description of the case, i.e. municipal home care services in Helsinki, with some important contextual considerations. Then I will explain the data collection and analysis processes, and finally consider important aspects of research ethics concerning this study.

4.1. Case study

In this thesis I have followed the basic features and procedures of a case study (Yin 2014). According to Gillham (2000) a 'case' can be anything from an individual to an institution. As mentioned, I will focus on heatwave adaptation in the municipal home care services in Helsinki. Gillham (2000) and Yin (2014) state that in a case study, the main interest is in *processes* leading to a certain outcome. They continue that those processes can be understood by interpreting people's perceptions of events within them. Home care workers perceptions of heatwaves' effects to customers and services are the main interest of this study. Yin (2014) adds that a case study is suitable for real-life phenomena for which the researcher has little to no control of. A naturalistic approach such as that in a qualitative

case study works well with studying human-related phenomena because those are usually context-specific and attempting to generalize no longer makes sense (Gillham 2000). Hinkel and Bisaro (2016) suggest that case study might be a plausible approach for solution-oriented adaptation research interested in identifying adaptation measures. Understanding the effects of heatwaves and related adaptation needs in home care setting in Helsinki requires context-specific understanding, and hence a qualitative approach can be justified. This approach can allow me to generate contextually sensitive data for the purposes of developing heatwave preparedness and adaptation in the city organization based on workers actual experiences of heat.

4.2. Municipal home care services in Helsinki

Municipalities have provided home-based services since 1950s, first for families with small children, and later increasingly for the elderly and chronically ill (Anttonen 2009; Kröger, Puthenparambil & Aerschot 2019). Home care services are part of social services, and the broad purpose defined in the Social Welfare Act (1301/2014) is to enhance and maintain the functioning abilities, social wellbeing, safety and inclusion of individuals, families and the community. Services offered by the city of Helsinki are targeted for the elderly, people recovering from temporary illness, chronically ill and disabled people over the age of 18, who are not able to independently get by daily activities such as eating, washing and dressing. Services contain different functions from care, nursing to support such as grocery shopping, cleaning and laundry. Home care services in Helsinki are part of the 'hospital, rehabilitation and care service' -department together with other services provided for the elderly and people with multiple illnesses. Municipal home care services in Helsinki have more than 1700 employees. The services are divided into eight regional units covering all parts of the city. Each of these units have more than 100 employees; practical nurses being the biggest occupational group. (City of Helsinki 2020.)

The elderly are the largest group receiving home care; 71% of all home care patients in Finland are 75 years or older (Saukkonen *et al.* 2020). The total amount of home care recipients in Helsinki is around 15 100. This number includes customers receiving regular care as well as those receiving only support services or temporary assistance. (City of Helsinki 2019.) The amount of regular care receivers is around 7000 (City of Helsinki 2021a). The number of annual visits and phone calls in all regions was approximately three million, and an average amount of monthly visits 241 000 in 2018 (City of Helsinki 2018).

The coverage of home care in Finland has shrunk over the past decades. By the end of 1980s almost half of the population aged 75 or older in Finland received home-based services (Henriksson & Wrede 2011), but from the 1990s onwards services were more strictly targeted (Kröger & Leinonen 2012), and coverage has since reduced (Kröger 2019). Due to the stricter targeting of customers as

well as favoring home care over institutional care, the number of customers needing a lot of services has been growing. Customers are in worse condition than before, have multiple illnessess and in need of all kinds of care and support. In 2017, 36% of home care patients in Finland were those that needed more than 60 visits a month. (Kehusmaa *et al.* 2018.) According to a nation-wide survey, each patient is visited twice a day on average. A family member participating in the care is relatively common, although no specific data is given about this. (Alastalo & Kehusmaa 2018.) In the future, as the population ages, need for care is expected to increase, especially in southern Finland (Kehusmaa *et al.* 2018).

At the same time the care sector is suffering from lack of staff both in Finland and across Europe (Kehusmaa *et al.* 2018). Between 2014 -2016 the amount of home care patients in the Uusimaa region grew by 40% while the overall amount of staff and the frequency of visits fell (Alastalo, Vainio & Kehusmaa 2017). The loss of staff is linked to unavailability of qualified staff - there are simply not enough trained practical nurses and home aid. On the other hand, between 2014 – 2018 amount of staff has increased by 10% in Uusimaa, which indicates small improvements after 2016. (Kehusmaa *et al.* 2018.) Work is often concidered hectic, and not always fulfilling home care recipients needs (Kröger & Leinonen 2012). Wellbeing of staff in home care on the national level has decreased (Vehko, Sinervo & Josefsson 2017). During the 2000s satisfaction of care recipients concerning the adequacy of services has decreased (Kehusmaa *et al*. 2018), although the satisfaction of customers receiving municipal care in Helsinki has increased between 2016 – 2018 according to the municipalitys own survey (City of Helsinki 2018). When asked about the ability of patients to participate in meaningful activities (such as going out, hobbies or social interaction), home care patients seemed to have fewer opportunities (in less than half of cases) compared to senior care facilities (Alastalo & Kehusmaa 2018).

The Finnish government has recently revised the law concerning round-the-clock elderly care to ensure adequate staff-availability. This could potentially move workers from home-based services to round-the-clock care, which could further accelerate problems in home care. Furthermore, a large proportion of current municipal staff in the care sector will retire by 2035, and new care professionals are not entering the workforce in a similar volume (Honkatukia 2019). How can the quality of services and the wellbeing of customers be maintained with these contradictory trends in place, and with climate change potentially increasing the stress for these services? What if multiple crises occur simultaneously, such as a pandemic and a heatwave? Understanding local capacities to deal with change, and how they can be supported is important for present and future sustainability (Wamsler 2014).

4.3. Data collection

The literature review (Knopf 2006) method I used for the theoretical part of this thesis was a rather traditional one. I used search words such as 'heatwave', 'local adaptation', 'adaptive capacity', 'vulnerability', 'heat' and 'health care' in both Google Scholar and the University of Helsinki's search tool Helka to find relevant articles. The references of relevant articles as well as articles that had cited relevant literature helped to trace appropriate academic sources. I stopped the literature review once (new) relevant knowledge seized to surface, although later in the analysis phase I returned briefly to the literature search. The outcome of the literature review was, that there are no studies conducted in a similar context, but I chose relevant articles that overlapped the topic.

Yin (2014) states that there are four basic principles for gathering data in a case study: using multiple sources of evidence, creating a case study database, maintaining a chain of evidence and exercising caution with internet sources. As a primary source of evidence, I collected interview data concerning home care workers perceptions of heatwaves' effects in the home care setting. I used documents related to the organization's preparedness to heat as a secondary source. I kept all data in an organized manner within digital folders secured with a password. A thesis-diary functioned to organize the work but also to maintain the chain of evidence (cf. Yin 2014). To provide relevant additional information and perspective I used some credible internet and 'grey' literature sources. Such were, for example, knowledge of home care service provision, dwelling structures in Helsinki and expert reports related to climate change adaptation within the health sector.

Interviews are a common method in collecting data in case studies (Yin 2014). I held semi-structured interviews (Adams 2015) with 8 people working in home care; 6 from the operational level and 2 from the strategical level (see Appendices 1 and 2 for interview guides and Table 2 for List of interviewees). I recruited the interviewees from northern and northeastern service areas (2/8 of all service areas) with the help of a contact person within the services. According to Kazmierczak (2015), citizens who potentially have high or very high social vulnerability to heatwaves can reside within these areas. Interviewees were practical nurses (4/8), nurses (2/8) and home care instructors (2/8) by occupation. While operational staff hold the potentially most relevant knowledge regarding this study, I included strategical staff since they can have important insights concerning the preparedness of services to heat. Sampling strategy I used was purposive sampling (Kyngäs *et al.* 2011). The criteria for the potential participants were as follows: participants should have experience of 1) working during heatwaves, 2) working with customers who are especially vulnerable to heatwaves (such as high indoor temperatures and limited cooling possibilities).

I conducted the interviews in Finnish, and gave the participants the option of being phone-interviewed or interviewed online via Microsoft Teams. Finally, two telephone-interviews and six online interviews took place during February and March 2021. Interviews lasted between 20 – 45

minutes (35 minutes on average). To record the interviews I used either a computer-based recording program (telephone interviews), or the in-built recording feature of Microsoft Teams. The recordings in Teams were private, only visible to me and deleted from the server after dowloading them to my own files. I transcribed the interviews manually, and in their original language (Finnish). I translated the quotations that were included in the results in English. Original quotations can be found in Appendix 3 for comparison.

Table 2 List of interviewees

Interviewee	*Length of the interview*
Participant A	30 min
Participant B	30 min
Participant C	43 min
Participant D	45 min
Participant E	44 min
Participant F	35 min
Participant G	30 min
Participant H	20 min

Yin (2004) states that a researcher should use multiple sources of information to understand the case in its context. As a secondary source of evidence, I used intra-organizational instructions for heat-waves from 2018 and 2019 as well as a letter from the Ministry of Social Affairs and Health for all Finnish municipalities during the 2018 heatwave (Table 3). I compared these to the interview data to further enhance or contradict the findings, and to gain more insight into the measures taken on the strategical level. Of interest was how workers had been supported in their adaptive efforts.

Table 3 List of secondary sources

Document 1.	'Heat guidelines for people working with the elderly'	2018	Social Services and Health Care Division, city of Helsinki, Finland
Document 2.	'For home care staff: Working in hot weather'	2019	Social Services and Health Care Division, city of Helsinki, Finland
Document 3.	A Letter to municipalities and health care districts concerning heat health risks and protecting the elderly from heat	2018	Ministry of Social Affairs and Health, Finland

4.4. Data analysis

I began the analysis by reading and re-reading the transcripts over multiple times. Afterwards I produced short summaries from each interview using respondents' own words. I kept separate notes with thoughts and ideas regarding the data and its analysis on the side. Keeping personal notes is recommended for case study researchers as well (Yin 2014). Then I revisited the pre-established theoretical framework and literature review to clarify which analysis tools are needed for the data.

Bengtsson (2016) has outlined the phases of a qualitative content analysis, which I followed. Bengtsson (2016) breaks the process of qualitative content analysis into four main phases, which I will describe in short in the following. (1) During *de-contextualization* I broke the data into smaller meaning units. These can be words, sentences, or whole paragraphs. Within the data I had collected meaning units were mainly one or more sentences. (2) Then I identified the meaning units of the data that were of relevance to the research questions. This is called *re-contextualization*. (3) I placed the identified meaning units under relevant categories (*categorization)*. (4) Finally, in the *compilation* -phase I presented the results in a form that followed the order and logic of the research questions outlined in Chapter 1. In a case study, the results are usually presented in a narrative form (Gillham 2000). I wrote the results in a way that describes and represents the data, while comparing when relevant to existing body of research or other important pieces of knowledge. The analysis can be described as manifest (surface-level) (Bengtsson 2016), staying close to the meanings and contexts of the data.

I conducted the coding process using the Atlas.ti software. The coding and analysis logic I used was abductive. To develop theory-based codes I used the frameworks of Wilhelmi and Hayden (2010) as well as Wamsler and Brink (2014a) and Wamsler (2014) concerning vulnerability to extreme heat and adaptive practices. In addition to this, I used an open coding method to derive categories inductively from the data. While there was an idea of what to look for in the data, the inductive approach allowed me to stay open for what might arise from the data itself. The first "trial-round" of coding produced 54 codes. As the codes should be mutually exclusive in the sense, that one meaning unit should not fit under multiple codes (Bengtsson 2016), I cleared the preliminary codes for any overlapping concepts. Then, using this coding skeleton I coded the data again. This time there remained 38 codes which I could categorize under 7 different categories. I then evaluated these based on how relevant they are in the light of the research questions. Eventually there remained 6 main categories, 4 out of which had direct relevance to the topic at hand (see Appendix 4 for the coding tree).

4.5. Research ethics

I followed the basic ethical guidelines provided by the Finnish Advisory Board on Research and Integrity. I applied for and was admitted a research permit from the city of Helsinki. Participation in the study was voluntary. I conducted the interviews during interviewees' work hours. I sent

information letters, data protection statements and interview guides to participants prior to the interviews, and also discussed these with participants in person. Participants were given the opportunity to ask questions about anything that might have remained unclear. I asked for permission to record the interviews in the beginning of the discussions, and orally collected and recorded informed consent.

I informed participants of the option to restrict the use of the data collected from them partially or completely at any point during the study. In addition, I informed participants that there are no right or wrong answers to the interview questions, and that they can at any point refuse to answer any questions they do not want to. We agreed with participants that their anonymity is secured when reporting on the findings both in this thesis and within their organization. The results of this thesis can be used to inform heatwave adaptation planning regarding the city of Helsinki's home care services. A Finnish summary of the results presented in this document will be provided for the organization.

To protect participants identities, I removed names and all other recognizable data (such as detailed background information) during the transcription phase. I created pseudonyms for each participant (see Table 2). No such direct quotations or other data was included in the results which might break anonymity of participants. My intention was to include direct quotations in the results in a way that represents all participants' voices equally, and to report on the findings in a manner that accurately desribes all relevant data, and does not shy away from complexity and contradictory views of different participants.

5. Results

First, I will shortly consider the nature of work in home care, lack of resources and specificities of the summer season as these were brought up in the interviews. They will help in understanding the results in their respective context. Then I will move on to describe workers experiences of sensitivity and exposure to heat in home care to identify some potential challenges that they might have posed to the services. I will then analyse taken adaptations to solve these challenges by using conceptual tools outlined in Chapter 3.

5.1. Contextualizing the results

Work in home care is mobile; commuting between customers and the office and conducting varying care tasks related to medication, food, and hygiene. Workers move by foot, bicycle, or car. According to the interviewees the longest distances between customers can be up to 7 kilometres. Interviewees describe the number of visits fluctuating approximately between 5 and 17 per day. The time spent at

a customer varies and can be anything from 10 minutes to more than an hour, but 30 minutes on average. The work tasks and responsibilities differ between home care instructors, nurses, and practical nurses. Nurses and practical nurses are the frontline workers involved in the care of the customers. Nurses described their typical day as consisting of customer visits in the morning / noon, and office work in the afternoon. Practical nurses typically have customer visits all day. Home care instructors work in the office environment, planning and developing the operations, answering customer queries, leading staff, leading meetings, and recruiting new workers. Interviewees describe the work as being demanding, highly responsible, busy, unpredictable, and exhaustive, but also rewarding.

As mentioned, care sector in Finland, including home care services, are suffering from a chronic lack of staff that has been linked to unavailability of trained professionals (Kehusmaa *et al.* 2018; Honkatukia 2019). This theme was discussed in 6/8 interviews. As the number of customers increases while staff availability does not necessarily follow up in a similar manner, it has many results in how the work is organized and perceived, as pointed out by the interviewees: increasing the workload, making work more responsible and creating pressure to shorten customer visits to respond to the shrinking workforce and growing demand. One interviewee mentions that this can make people question their choice of profession, and that the work might not seem appealing anymore to young potential workers. Some interviewees describe that they cannot always attend to all the customers' needs. Although the situation fluctuates, meaning that some days are better than others, a common understanding is that the workload has been increasing over the recent years. The intensified needs of individual customers are also visible. One interviewee describes that many people are in poor condition, would need institutional care and instead go between hospital and the home, which employs emergency duty. The busy nature of the work is depicted in the following comment:

> *"(...) but very often it is so that we only do the necessary. We secure the critical needs, we take care that the person has food and the medication they need, and then we go to the next place to take care of the same things (...)."*

Summertime, when heat risk is prominent, is also the holiday season for permanent staff. This can mean that responsibilities are even bigger for the remaining more experienced workers. Some of the work time goes to supporting and guiding the summer workers. While summer workers are described as enthusiastic, their experience level and ability to take responsibility varies. If summer workers do not have medication licences, this means more work and responsibility for remaining permanent staff. One interviewee describes that there might not be enough time for sufficient introduction period for the seasonal staff. There can also be recruitment challenges to secure enough staff for the summers. The specificities of the summer in terms of staff structure will most likely have implications

for how well heatwaves can be managed in the future, and summer workers are among key actors to protect customers from heat.

5.2. Sensitivity to heat in home care

When asked about experiences of the 2018 heatwave or alternatively hot summers in general, interviewees describe the living conditions of customers, how heat has affected both customers and their own wellbeing, how these challenges have been addressed and what kinds of challenges are related to taken adaptive practices. Five out of eight interviewees had worked during the heatwave in 2018. These include all practical nurses and one nurse. Nevertheless, all interviewees had experiences and thoughts to share regarding effects of heat in the everyday practices of home care. All interviewees describe that heat affects both customers and workers to varying degrees.

5.2.1. Customers' age and health

As most home care customers are elderly, the combination of high age and chronic illnesses can make customers more sensitive to heat. It needs to be noted that not all home care customers are elderly. Younger people might have for example severe mobility restrictions, which also increases sensitivity to heat, but these were not discussed in the data, because most interviewees had mainly elderly customers.

Interviewees describe observing symptoms such as fatigue, breathing difficulties, heart problems, loss of appetite and even weight loss in customers during the 2018 heatwave. All of these are common symptoms of heat exhaustion (Hunt, Parker & Stewart 2013). Heat can decrease the functioning capacity of customers even more than usual. One interviewee describes that some customers' heart problems can prevent physical activity altogether during heat, which can mean that even going outdoors/out of the home to find some shade might be out of the question. On the other hand, two interviewees describe that the elderly rarely complain feeling hot, as they can be more prone to feeling cold. As mentioned, the functioning of the thermoregulatory system changes due to aging (Kollanus & Lanki 2014), and hence the perception of heat of elderly persons can be affected.

Customers' hydration is a challenge throughout the year and emphasized during hot weather. Aging and illnesses can affect thirst perception. Interviewees describe that customers might forget to drink due to dementia, not recognizing thirst, or due to not being able to use the toilet independently. This can lead to cases of dehydration. It requires emergency care and is a common heat-related health problem (Miller 2014). Half of the interviewees (4/8) described having dealt with cases of dehydration. Some interviewees perceived them as a regularly occurring phenomenon. No interviewees mentioned encountering heat-related deaths in home care. Nevertheless, it is mentioned by the Ministry

of Social Affairs and Health (2021) that heat-related deaths have also occurred in home care in Finland, although no further elaboration of this data is provided.

5.2.2. Customers' living conditions

The characteristics of risky living conditions identified by interviewees include apartment buildings with no elevators, small studio apartments and old detached houses with poor maintenance.

Interviewees describe that many customers live alone in small studio apartments. In Finland, almost half of people 75 or older live alone, and a large proportion in apartment buildings (Official Statistic of Finland 2020). Although living alone does not equal loneliness or social isolation, it does suggest there is no immediate access to help. Those small homes that do not allow for cross-ventilation can get very hot, and this creates not only health risks for customers but a challenging working environment for the workers. Indoor spaces with no air-conditioning can decrease the ability to concentrate and capacity to work (Mayer *et al.* 2020). It is mentioned that buildings are often old and air conditioning devices are rare. Workers have observed dangerously high indoor temperatures in customers apartments both during the 2018 heatwave as well as other summers. One interviewee describes that during the 2018 heatwave customers' apartments felt 'like a sauna'. During the past summer (year 2020) one interviewee had noted an indoor temperature of 36 degrees Celsius at some customers' apartments. This means that the safety limit has been crossed, as according to World Health Organization (2011, p. 18) room temperatures '*should not exceed 32C during the day'*, and a similar limit has been set for residential dwellings in Finland[1].

Heat-problem was not only connected to small studio apartments but to some detached houses. Interviewees describe that in their service area there are many old detached houses that are in poor condition. Some customers might not for example have access to a shower or an indoor toilet, although this is not very common. It is mentioned that portable toilets can become a severe health hazard during heat if not emptied frequently enough. Interviewees mention that the covid-19 pandemic has resulted in temporary closure of many services such as saunas and indoor swimming pools in which customers can get a shower and refreshment in these cases.

Apartment buildings with no elevators are discussed by multiple interviewees. Many old buildings in Helsinki do not have elevators, which can restrict the customers mobility and prevent escaping the hot indoor conditions. In 2016 more than 22 000 elderly people in Helsinki lived in apartment buildings with no elevators, because the building stock of the city is old, and elevators have only become more common after 1990s (City of Helsinki 2021b). Interviewees describe that some customers are 'prisoners' in their own homes, due to having physical restrictions or otherwise not able to move

[1] Decree of the Ministry of Social Affairs and Health on Health-related Conditions of Housing and Other Residential Buildings and Qualification Requirements for Third-party Experts (545/2015)

outside of the home alone. This can also affect customers' access to taxi services, if these service providers do not have stair climbing aid or are inexperienced in using them.

5.2.3. Workers' sensitivity: occupational factors

Regarding workers' own health during hot weather, interviewees had mixed experiences. This can partially be explained by differences in their work tasks, and whether they had worked during 2018 heatwave. Two out of eight (2/8) interviewees described symptoms such as having a headache, feeling dizzy and having fatigue during the 2018 heatwave. One interviewee mentions that during a hot day it is more difficult to maintain a positive attitude, which may be reflected in the quality of care. Hot days are described as exhausting and energy consuming, as mentioned by this interviewee:

> *"(...) we are quite tired during hot days; they take a lot of energy. There is headache and it is very exhausting for both workers and customers."*

Home care workers conduct critical tasks such as taking care of customers' medication, and tiredness caused by heat in this context can be dangerous. One interviewee describes being afraid of making mistakes due to heat exhaustion and added having to use all free time to recover from dehydration. This exhaustion was linked to not being able to take breaks and hence not hydrating properly, which was caused by limited access to the office due to time pressures of the work. It is described that it would take too much time to commute to the office for a lunch break and then return to the field. In order to manage the length of the working days and securing that customers' needs are attended to, workers describe limiting their own breaks. One interviewee mentions that this does not, of course, help with workers' own wellbeing. Recently, corona has closed many places, such as service centres, where workers have previously been able to take breaks if they are closer than the office.

On the other hand, some described coping well in heat in general, and were more worried about the patients, many of whom cannot escape the hot indoor conditions. These comments came mainly from the strategical positions, and therefore from people less engaged in the everyday care of customers. Two interviewees point out that working in the summertime is nice, because the environment is beautiful, and weather is mostly pleasant. Moreover, *dark winters* were mentioned as more mentally and physically demanding. One interviewee describes how extreme winter conditions with a lot of snow and slippery streets are also very demanding for workers, as they need to commute daily between customers' homes regardless of the weather. Some mention the work outfit to be unsuitable for extreme conditions, and the backpack (which has all the essential equipment) they carry weighs 5 kilograms, which adds to the exhaustion. It was mentioned that distances by car are generally short, and the air-conditioning in the car does not have time to work in between visits, and hence is not a plausible cooling option during heat.

5.3. Heatwaves can cause a two-fold challenge for services

As has been described previously, heat can create challenges both for customers and workers well-being, therefore implicating a two-fold challenge: increasing the need for care due to decrease in customers functioning ability, while simultaneously decreasing the working ability of home care staff due to thermal stress. This is a potential challenge also recognized by Jonsson and Lundgren (2015).

However, interviewees had mixed experiences regarding the service demand growth. Some mentioned that heat had caused them to increase the number of visits, or at least that there is a need for more visits even though resources might not be enough to respond to that need effectively. A few interviewees had not experienced any changes in frequency of visits during extreme heat. The lack of resources is mentioned as a challenge to adapting to changing needs, as depicted in the following comment:

> *"There is of course that thing, that we're already fully employed by the basic visits, so then, can we acutely increase visits, it is also quite challenging. But of course, if a customer's wellbeing requires, we will increase the visits."*

In the context of having limited resources, increasing visits to alleviate customers' heat stress might mean more work for people already at their limits with the amount of work. Moreover, if this reflects to other customers having shorter visits and workers being more exhausted the whole system might become more vulnerable.

Heat might cause medication and food spoilage. Problems with managing the temperatures in medication storage rooms have been experienced in institutional care facilities. However, none of the interviewees mentioned having problems with medication or food during heat, although one interviewee did express this as something that requires consideration during extreme heat. It needs to be noted, that since medications are stored at customers' homes, they need to be kept below 25 degrees Celsius or in the refrigerator, since high temperatures can '*reduce the efficacy'* of those medications (World Health Organization 2011, p. 12). As mentioned, at least one interviewee described that the 25-degree limit in room temperature had been crossed at least in some customers' homes even the previous summer, when there was no exceptional heatwave.

5.4. Adaptation and adaptive practices in home care

In the following the adaptive capacity of municipal home care services in Helsinki will be explored by describing and analysing taken practices. Interviewees identified 13 adaptive practices in total (Table 4). Hydration (7/8), cross-ventilation (6/8) and use of fans (4/8) gained most mentions. Most measures were taken by operational staff, but a few concerned customers families or the services'

strategical staff. First, the strategical measures will be presented, followed by workers measures and families' roles. Finally, potential capacities will be explored.

5.4.1. There are no long-term plans to cope with heatwaves

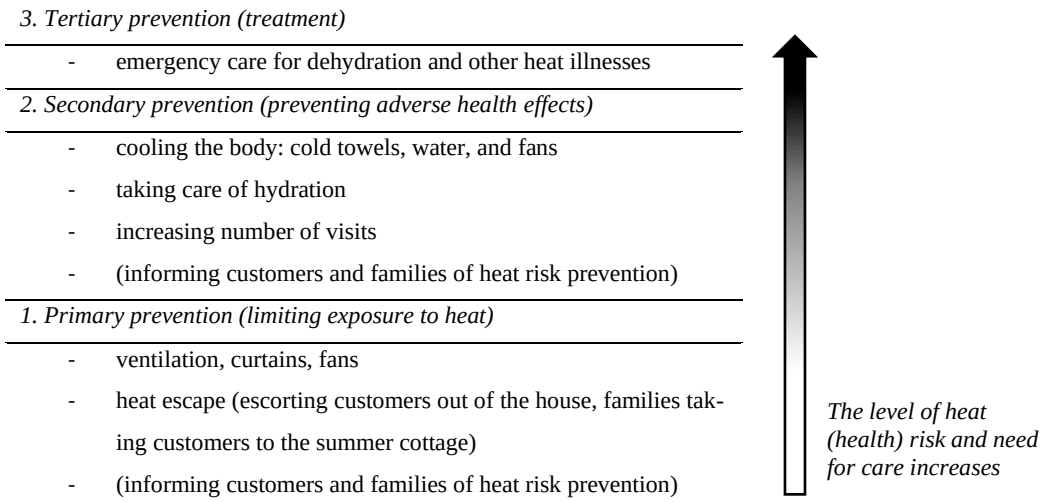
In the letter sent by the Ministry of Social Affairs and Health concerning the 2018 heatwave, municipalities and health care districts are asked to emphasize preventive measures, such as: contacting homes, providing more day activities for the elderly (services that support customers with memory disorders and/or who are in informal care), organizing temporary housing and transporting people in air conditioned cars to cooled spaces, conducting 'check-in' visits for vulnerable citizens and providing citizens with instructions for managing heat risk in small city apartments. In addition, encouraging community care such as care provided by volunteers, families, neighbours and housing/building associations is emphasized. It is also mentioned that climate change will likely increase the frequency and intensity of heatwaves in the future, and this requires preparedness measures from the health sector. Moreover, it is stated that workers own wellbeing and needs, such as taking enough breaks and hydrating properly, require increased attention, even though many actors shrink service provision to handle staff shortage during the summer.

In practice, however, strategical staff identified no systematic preparation to adapt to heatwaves in home care. It was mentioned that they try their best, but no long-term plans or guidelines on how to proceed during a heatwave exist. Two strategical-level measures were identified: heat-specific work instructions and providing mineral water bottles for the staff. The instructions from 2018 and 2019 provided by the organization emphasize workers behavioural adjustments, such as cooling indoor spaces, wearing appropriate clothes, hydrating properly, and staying in touch with customers families. Workers were instructed to take a 10 or 15 -minute break once an hour when the room temperature exceeds 28 and 33 degrees Celsius. The instructions were perceived by some as difficult to follow in practice due to lack of resources and lack of access to appropriate break facilities. Some interviewees did not remember getting instructions at all. Although the instructions seem rather simple, in practice they are not necessarily easy to apply, as will be described in the following chapter.

5.4.2. Home care workers have an active role in adapting to heat

As expected, workers' adaptive practices were short-term adaptations aimed at preventing adverse health outcomes. They can be categorized as follows: limiting exposure to heat (primary prevention), preventing adverse health effects (secondary prevention) and treating heat-related illness (tertiary prevention) (Figure 2). The emphasis of interviewees descriptions was on secondary prevention.

Figure 2 List of home care workers heat-related preventive practices (adapted from Ebi & Semenza 2008; Kovats & Hajat 2008)



Limiting exposure is most effective in preventing heat-related illness (World Health Organization 2011) and hence managing the need for care. Interviewees describe attempting to cool customers apartments with cross-ventilation, ventilation from the shaded side of the building, and using curtains. However, many agreed that the ability to cool customers apartments is limited. First, customers live in their own homes and have autonomy over decisions made regarding the home environment, as they should have. People might refuse to open windows, because they might suffer from the draft, feel cold themselves or become disturbed by noises or pollution from the outside. Secondly, customers have differing living conditions and resources for adaptation. For example, some might not have adequate curtains for shading, and the layouts of apartments might prevent cross-ventilation. Third, the success of cross-ventilation also depends on the weather. If there is no wind, ventilation does not work. Air-conditioning devices are rare. Workers describe doing all they can to help customers, but there are certain limits to how much they can do:

> *"(...) of course, things such as the size of the apartment and ventilation possibilities can't really be affected."*

In the organizations' internal heat guidelines, it is advised that at least part of the day should be spent in below 25 degrees Celsius. Some interviewees mention having taken customers outside from the house to find some shade. As mentioned, in some countries, public cooling centres are a common practice to manage heat (health) risks (Mees, Driessen & Runhaar 2015). When asked if there are any such places for home care customers, the answer was negative. One interviewee describes that the only other place is the hospital.

Table 4 Coping/adaptive practices in municipal home care in Helsinki (adapted from Wamsler 2014; Wamsler & Brink 2014a)

Coping/adaptive practice [number of interviews mentioned]	*The objective*	*Thematic focus*	*Hazard focus*	*Patterns of social behaviour*	*Timing and awareness*	*Support from the organization*
Drinking more fluids / taking care of customers hydration [7/8]	Response / Vulnerability reduction	Physical	Heatwave specific	Individualistic / communitarian	During heatwave / Ad hoc / deliberate	Mentioned in the instructions.
The organization offering mineral drinks for the staff [6/8]	(Preparedness for) response / Vulnerability reduction	Physical	Heatwave specific	Communitarian / Hierarchical	During heatwave / Planned / deliberate	Organizational/institutional measure.
Cross-ventilation [6/8]	Response / Vulnerability reduction	Physical / Environmental	Heatwave specific	Individualistic/ Communitarian	During heatwave / Ad hoc / deliberate	Mentioned in the instructions.
Use of fans [4/8]	Response / Vulnerability reduction	Physical / Environmental	Heatwave specific	Individualistic / Communitarian	During heatwave / Ad hoc / deliberate	Not mentioned in the instructions.
Taking customers out of the house if outside is cooler [3/8]	Response / Vulnerability reduction	Social / Physical / Environmental	Heatwave specific	Communitarian	During heatwave / Ad hoc / deliberate	Not mentioned in the instructions.
Increasing number of visits [3/8]	Response / Vulnerability reduction	Social	Non-hazard specific	Hierarchical/ Communitarian	During heatwave / Ad hoc / deliberate	No instructions available. Might be challenging if not enough staff.
Curtains and shades [2/8]	Response / Vulnerability reduction	Physical / Environmental	Heatwave specific	Individualistic/ Communitarian	During heatwave / Ad hoc / deliberate	Mentioned in the instructions.
Salt intake / food [2/8]	Response / Vulnerability reduction	Physical	Heatwave specific	Individualistic/ communitarian	During heatwave / Ad hoc / deliberate	Not mentioned in the instructions.
Asking customers families to help [2/8]	Response / Vulnerability reduction	Social	Non-hazard specific	Communitarian	During heatwave / Ad hoc / deliberate	Mentioned in the instructions.
Families/relatives taking customers to summer cottages [2/8]	(Preparedness for) response / Vulnerability reduction	Social / Physical / Environmental	Non-hazard specific	Communitarian	Not necessarily related to heatwaves	-
Using cold towels to cool the body [2/8]	Response / Vulnerability reduction	Physical	Heatwave specific	Individualistic / communitarian	During heatwave / Ad hoc / deliberate	Mentioned in the instructions.
Monitoring the physiology of the customer [1/8]	Preparedness for response	Physical	Non-hazard specific	Communitarian	During heatwave / Planned / deliberate	-
Workers reducing physical activity after work [1/8]	Recovery	Physical	Heatwave specific	Individualistic	During heatwave / Ad hoc / deliberate	-

If exposure cannot be prevented at all, secondary prevention aims at minimizing adverse health effects of heat. The main emphasis was on hydration. Interviewees describe that during heat they have monitored the fluid intake and overall physiology of the customers more carefully. As mentioned, many health conditions such as physical restrictions and dementia, as well as simply reduced thirst perception due to old age, can create challenges for hydration.

> *"The hydration has been an issue as long as I can remember. It is emphasized during heat days (…) and then there will be more emergency gigs due to dehydration, especially during a longer heatwave (…) When we're not 24/7 present, and we can't force people to drink (…)."*

One interviewee describes that there are products that can support the fluid balance, but they are not necessarily suitable for people with multiple and underlying chronic illnesses. Hydration is especially important for people with certain medications that remove fluids from the body. As mentioned earlier, there were also challenges in taking care of workers own hydration during heat due to not being able to take breaks or have access to break facilities. Other measures mentioned were using cold towels and water to cool themselves and asking families or social workers to buy fans for customers. One interviewee describes keeping a cooler in the car with some wet towels to occasionally wipe the forehead and neck to feel a bit cooler.

The 'last resort' in preventing the more serious consequences of heat is emergency care. As mentioned, some cases of dehydration have occurred. The frequency of this phenomena is difficult to assess as there were no statistics or other research to be found. One interviewee expresses frustration over the fact that staff in emergency care 'do not like' that home care customers must use their services, although they have tried their best to avoid the worst outcomes. It is mentioned that the work in home care, and how much is done to prevent customers' hospitalization is not measured and brought into attention, and hence is invisible to others.

It needs to be noted that the World Health Organization (2011) lists hospitalization as a risk factor for heat-related illness and mortality. This is not only because of people's poor health condition in hospitals, but also lack of appropriate air conditioning in many facilities. As most heat-related deaths in Finland have occurred in institutional settings (Kollanus & Lanki 2014), hospitals are not necessarily safer places for home care customers, at least if heat risk management in the care facility or hospital has not been considered.

5.4.3. Customers' family relations are diverse

In Finland as a whole, 12% of public and private home care providers say that at least 2/3 of customers have families participating in the care (Alastalo & Kehusmaa 2018). Families and relatives are

described to be in a key role regarding taking care of the safety of customers home environment and helping them during heatwaves if they are involved in the care.

> *"And of course, there are those (families), who take their elderly from the hot apartment to for example the cottage, if it is possible to go there, and possible to cope. So yes, indeed the role of relatives is very big, when there are some, and they have resources (to help)."*

Families were discussed in relation to two roles, both of which help to reduce the exposure (primary prevention) to heat: taking customers to the summer cottage and buying fans to customers' homes. Some interviewees describe asking families to bring fans and helping to take care of customers during hot weather. Interviewees state that most families with the ability to participate in the care have helped when asked.

> *"(...) we of course contacted the families, and asked them to also visit there, and bring those fans there at home, to ventilate the apartments (...)."*

Some interviewees also described informing customers and families about heat risk and appropriate measures to prevent adverse health outcomes. However, the form and contents of this was not further elaborated on. Requests to wear appropriate clothing, reduce physical activity and take care of fluid balance might not be plausible if an elderly person has dementia or other cognitive impairments.

However, not everyone has a family who wants to get involved, lives nearby or exists at all. Interviewees describe that family members can be elderly siblings in need of assistance themselves or live far away unable to provide local help. Many home care customers live alone and have no social networks other than those provided by the services, although the customers change and hence the situation fluctuates somewhat. It is mentioned that when customers do not have families, the responsibility of home care services is emphasized. One interviewee describes how home care can be the only contact to the outside world for some customers. However, home care services do not have resources to provide cooling technology for customers' homes. Social workers can help low-income customers in this respect. One interviewee mentions contacting social workers to help some customers to get fans for their homes. Home care workers might not be fully able to compensate for the lacking family help, because their resources are limited. One interviewee talks about a need for 'a sense of community care', and that too much responsibility falls for the service providers in the Finnish society. On a more positive note, some customers might not need familial support due to a relatively good functioning capacity.

5.4.4. More 'helping hands' might be needed

Mees, Driessen and Runhaar (2015) suggest that public health authorities should build collaborative networks with private and community actors to cope with climate change, and to integrate adaptation to existing networks. Collaboration between institutions and individuals is seen as highly important for successful adaptation (Field *et al.* 2014). Within existing networks there might be unused capacities (Wamsler 2014) to manage heat risk in home care. When asked about potential capacities interviewees recognize both internal and external capacities. Most suggestions have to do with bringing 'extra hands' to help with most vulnerable customers hydration and access to cool spaces.

When asked about what existing resources could be used to manage heat risk in home care, most interviewees mention the summer youth program, in which young people get work experience in home care by spending time with customers. One interviewee states that young people could be trained to help the elderly during hot weather. There are also support teams in which people with long-term unemployment get working opportunities and home care services extra help when needed. This is mentioned as a potential resource for heat. Neighbourhood circles provided by service centres for elderly people are mentioned as channels to spread knowledge regarding heat health risks and appropriate adaptation measures. Third sector organizations providing social assistance for vulnerable people are mentioned. One interviewee describes challenges related to support services not fitting the needs of home care, such as unreliability in service-availability, and short contact-windows during the day, when home care staff are doing customer visits. One states that the responsibility of organizing these networks should not fall on nurses as worktime is limited.

Interviewees also presented ideas related to developing practices during heat. Digital applications could be used for getting in touch with vulnerable customers and reminders for eating and drinking. Some digital applications are already at use for a limited number of customers, although not specifically for heatwaves. One interviewee suggests a checklist for heat for each worker to keep in their backpack, with information regarding how to cool the apartment, care for the customer and help oneself during hot weather. Rethinking work clothing with extreme temperatures in mind is suggested, as the same work clothing is used all year round and is described unsuitable for extreme conditions.

On the other hand, when asked about how interviewees would develop heatwave preparedness and adaptation in home care, one interviewee describes the situation as follows:

> *"(…) realistically it is so, that if we had enough staff everywhere, much else would not be needed, because then we could do those things. We could take the breaks and so on (…)."*

The comment emphasizes the broader adaptation needs of the workers and the services regarding securing enough staff, which is important all-year-round and even more so during a heatwave.

6. Discussion

6.1. Summary of findings

This study set out to explore how the heatwave in 2018 had affected the city of Helsinki's home care services, what measures workers had taken to cope with the resultant challenges, and how the organization had supported workers in their efforts. The results suggest that heat had caused challenges to both workers and customers in the form of heat stress. Therefore, heatwaves can impose a double challenge to home care services as they can simultaneously limit working ability and increase care demand. Some interviewees had experienced quite severe heat stress symptoms, while others had coped better, and were more worried about the capacity of customers to bear with heat. It was mentioned that cases of dehydration, leading to customers hospitalization, is somewhat common during hot weather.

It is noted that poor housing quality and poor tenure are real issues; many buildings in Helsinki are old and badly adapted to extreme heat. Moreover, many old apartment buildings in Helsinki do not have elevators, which causes accessibility problems for people with restricted mobility. Within these complex conditions, workers had navigated to help customers cope with extreme heat. Home care workers described limited ability to affect customers' living conditions and hence exposure to heat in customers' own homes. Main challenges had to do with small apartments with no cross-ventilation possibilities, and lack of access to other cooling practices such as air conditioning, fans and appropriate curtains. Thus, the main emphasis seemed to be on caring practices such as adjusting food and drink intake to prevent dehydration. However, hydration is also a challenge in home care when customers spend most of the time alone at home and might for example have dementia or restricted mobility limiting toilet access. As the work also defines the borders and structures of how to operate, workers are limited in their scope of how to handle heat stress and help customers.

While adaptation had been taking place on the operational level due to necessity, it was not so active within the strategical level, thus supporting the conclusions by Ung-Lanki *et al*. (2017) and Mayer *et al.* (2020) regarding low preparedness-level in the health sector. No heatwave preparedness measures were identified by the strategical staff. The only adaptive measures on the strategical level were providing free water bottles for the workers and spreading knowledge regarding appropriate behavioural adjustments during heat (how to cool indoor spaces, what to wear, how many breaks to take, how to eat and drink). However, on the operational level this advice was perceived by some to not be facilitated by working conditions, such as amount of work and access to the office. This emphasizes that practices on different levels do not necessarily support each other, indicating that there

might need to be more communication between these different levels to facilitate adaptation that is sustainable in the long run. As summertime causes changes in the staff structure of home care, summer workers knowledge regarding heat risk and heat adaptation requires attention in the future.

Home care workers seem to have an active role in adapting to heatwaves, but it is limited by thermal stress also affecting workers own wellbeing, the different conditions and resources of customers, as well as workforce shortage in the care sector. Although the practices were quite homogenous in terms of objective, thematic and hazard foci as well as underlying patterns of social behaviour, the coping measures interviewees described seem to be all the measures available for the home care workers to adapt to the challenges they had faced within the structures of the work. Although Wamsler (2014) emphasizes the importance of considering local adaptive practices as a system of multiple practices, the picture that can be drawn from the results is incomplete, because knowledge about measures taken by home care customers themselves, their families, housing providers and other community actors potentially involved are not (sufficiently) included. The role of families seems to be especially that of limiting exposure and helping customers to get access to cooling technology such as fans, at least from the perspective of home care staff. Most probably families and relatives are also involved in other roles.

In the beginning it was argued that home care services can increase the adaptive capacity of customers, and that climate change adaptation is at the so-called 'core business' of community-based health and social service organizations (Barnett, Gardner & Meyers 2015). Most of the adaptive practices identified in this study could indeed be labelled as vulnerability reduction of home care customers (see Table 4). As the care is provided in people's homes, workers have knowledge of customers' adaptation needs and potential to support local adaptive responses. Services might be able to support customers adaptive capacity at least in the following ways. By helping to limit exposure and reduce customers' sensitivity to heat customers will be in better health to respond to further stresses. Moreover, workers described mobilizing customers' existing social networks such as families and other service providers, informing families and customers of heat risk and appropriate adaptation measures as well as using networks to help low-income customers gain access to cooling technologies such as fans.

I found that the framework by Wilhelmi and Hayden (2010) provided a good tool to understand vulnerability to heat and locate home care services potential role in reducing that vulnerability. The concept 'prevention' (Ebi & Semenza 2008) proved to be very appropriate for this context as a synonym for adaptation, to describe the adaptive practices taken by the workers in home care. It also helped to pinpoint which practices might need to be emphasized in order to prevent an increase in need for care, which is important when talked about service resilience. The framework by Wamsler (2014) and Wamsler and Brink (2014a) was useful as it demonstrated how adaptation happens in a

system of adaptive practices in which different actors have different roles. However, it was less useful to depict only home care workers practices because these have a limited objective, as workers roles within this system is limited by the structures of the work. In addition, there seems to be significant overlap between different categories which makes the use of this framework complicated and the interpretations of the results less clear.

The approach of including health care workers voices in adaptation and vulnerability research seems fruitful in the light of this study. Instead of relying solely on expert opinion, the grassroots-level understanding of adaptation needs is required to inform policy and practice, as well as to contextualize and bring empirical evidence to top-down vulnerability assessments. The relevance of local contextual knowledge has already been demonstrated by other researchers. As an example, Mallon and Hamilton (2015) have shown how actors in the community-based health and social service sector are knowledgeable in predicting potential impacts of climate-related service failures to customers.

6.2. Limitations of the study

The limited number of interviewees and the relatively short timeframes of the interviews affect the quality of the data and the representativeness of the results. The time that I could use for the interviews was limited by workers' busy schedules as the interviews were conducted during interviewees' work hours. I faced challenges in recruiting the interviewees, especially due to the pandemic which caused many unexpected changes in the schedules of the home care service staff, and ultimately due to time pressures of finishing the thesis. My intention was to represent the experiences and perceptions of participants as accurately as possible, but it needs to be noted that they are not reported by the participants but presented through my own lense, which is the lense of an outsider.

The agency of the home care customers, and their families/carers, as well as temporary staff and summer workers are not addressed in this study. I acknowledge the importance of interviewing the elderly themselves for how they perceive heat in their own homes and how their own agency manifests in the context of heatwaves, as their experiences may differ substantially from those of the service providers. Including the perspectives of people labelled as vulnerable in climate change adaptation research, policy and practice is called upon within the literature (Malloy & Ashcraft 2020; Mayer *et al*. 2020).

A memory bias can possibly affect the interviewees' perceptions of events, especially as the last heatwave took place almost three years prior to this study. However, relying on many informants and the similarity of their experiences regarding the heatwave 2018 and extreme heat within the home care context in general make the results more reliable. While these results cannot be generalized to the whole of home care services in Helsinki, I trust that they reflect some important and universal aspects of how heat can affect these kinds of services.

Another potential limitation is the causal assumption I made between heatwaves and the experiences described by the interviewees, although I cannot prove that they are connected. However, taking the results into account, I do not find that it is a big threat to reliability. On a more fundamental level, while it is important to take into account the agency of the frontline workers, the methodology I used in this study was unable to reach understanding about changes needed on the structural levels of how home care services are organized.

6.3. Contribution to previous literature

This study was situated in the context of home care and described and analysed the adaptive measures that are possible for home care workers within the structures of the work. To my knowledge this kind of research has not been done elsewhere. It is filling the gap in research about effects of climate change on care service provision and local level adaptive practices.

Theory suggests that emphasis of heat risk management needs to be in primary prevention, meaning in practices aimed at preventing exposure to heat (World Health Organization 2011; Kovats & Hajat 2008). This study shows some of the practical challenges that can be related to preventing customers' exposure to heat in the home care setting. They were mainly related to the apartment characteristics and available resources of each customer, meaning not only financial and material but social resources such as support from family members. This supports the conclusion that vulnerability to heat might be socially determined, rather than mostly affected by individual characteristics such as age and health as is claimed elsewhere (e.g. European Environment Agency 2018). It also supports the notion that social networks can protect from adverse effects of heat, as suggested by Naughton *et al.* (2002). Other scholars within the field of local adaptation to heatwaves and extreme weather events have also emphasized the role of networks of care in protecting the most vulnerable from heat risk (e.g. Wistow *et al.* 2015).

Because the sensitivity and adaptive capacity of individuals is affected by the future of health care provision and infrastructure (Carter *et al.* 2016), it would be important to assess the future small and large-scale stressors towards home care. There is a clear contradiction between two future trends affecting home care services: shrinking workforce in the care sector and increasing demand in home care services (Kehusmaa *et al.* 2018). Staff shortage was a prevalent theme in discussions with participants of this study. Within the literature, staff shortage and economic restraints have been identified to commonly act as potential or actual barriers of climate change adaptation in the health sector both in Finland and globally (Yang *et al.* 2020; Mallon & Hamilton 2015; Mayer *et al.* 2020). The results of this study suggest that lack of resources might act as a barrier to heatwave adaptation also in the home care setting in Helsinki. Since experts have recognized large-scale organizational reforms as possible barriers to climate change adaptation, it is important to take note of the fact that

climate change has not been recognized in the ongoing Finnish public health and social services reform (as noted by Mayer *et al.* 2020), although it claims to emphasise societal changes (especially aging of population and increase in demand of services) and prevention as its core drivers.

Vulnerability to heat can be emphasized in cases where customers have no other contacts to the outside world other than home care. As some workers evaluated that heat stress has affected their own capacity to work, the dependency-relationship that customers can have to services can create a double sensitivity to heat, similar to that found by Malmquist *et al.* (2021) in Swedish preschools. Therefore, the adaptation needs of both customers *and* workers are important because they are inter-related. Such potential needs of home care workers identified in this study could concern appropriate break arrangements (workers' access to break facilities), appropriate work clothing and securing enough staff to manage people's workload. The study also demonstrates, as Jonsson and Lundgren (2015) as well as Frykman (2019) have noted, that local actors (in this case home care workers) have a lot of common-sense knowledge regarding adaptation to heat, and that heat-stress treatment is naturally integrated into the patterns of care as suggested also by others (Mees, Driessen & Runhaar 2015; Barnett, Gardner & Meyers 2015). However, what has not previously been demonstrated in context is how the different sensitivities and adaptive capacities of customers are also reflected in the patterns of care; how differing health and living conditions can affect the possibilities of how to care for customers.

Heatwave adaptation demands engagement from a variety of actors including individual citizens and communities, public health officials, third sector organizations, risk management officials, urban developers and designers, electricity and water distributors, building designers, housing providers and rescue services among others. Strengthening social infrastructure and connectedness might help to build resilient communities (Mallon & Hamilton 2015). For home care services to secure their basic service provision, other community actors might need to complement these services in protecting vulnerable people from heat. This is all the more important as the coverage of services in Finland has shrunk (Kröger 2019), and not all vulnerable people are necessarily connected to any (formal or informal) care networks (Jonsson & Lundgren 2015). However, regarding the third sector health and social organizations Mayer *et al.* (2020) state that their engagement in climate change issues is still young. There is clearly a need and potential for collaboration within this area between public and third sector organizations. As the interviewees recognized connections between home care services and the third sector, these existing networks could be explored for potential heat risk management approaches. As the results also indicate that different services do not always complement each other and there is a mismatch in needs and availability, coordination of and communication between different services requires further attention.

Reducing heat risk in the urban environment can include measures such as: providing policy and financial support for reducing heat risk in buildings and providing public education on heat risk management (Zaidi & Pelling 2015). Organizations providing shelter and support for homeless people could take heat risk into account in their work. Organizations offering training in self-preparedness for ordinary citizens could advocate for sustainable heat risk management such as behavioural changes, passive cooling practices and helping others. Rescue services could take power outages during heat into account in their work, as they have for power outages during cold[2]. There could be neighbourhood initiatives where residents on a voluntary basis help each other to deal with thermal stress. Municipalities could raise citizens' awareness of heat risk and appropriate adaptation measures and support vulnerable individuals' access to cooling practices. The city could explore the possibility of identifying potential cooling centres and providing shelter for people whose homes become too hot. On the long-term, climate resilience and heat vulnerability assessments need to be included in urban land use, planning and design (Zaidi & Pelling 2015).

Walker (2015, p. 73) points out that housing and community resilience are key '*social justice issues for people with disability and their carers exacerbated most by climate change*'. As the importance of limiting exposure should be emphasized, the 'climate resilience' of housing should gain more attention, as is suggested by many others (Kankaanpää 2017; Pilli-Sihvola *et al.* 2018; Tuomenvirta *et al.* 2018). Issues with housing, mainly lack of air conditioning and buildings poorly adapted to heat were also discussed in this study. In the home care context and in Helsinki, apartment buildings with no elevators are a specific risk factor for customers with mobility restrictions. It is argued elsewhere that health and social service sector might need to consider admitting income support for air conditioning to support vulnerable people's adaptive capacity (Mayer *et al.* 2020). However, there is a debate around the use of air conditioning with respect to energy use and potential implications for climate change mitigation and social vulnerability. While relying on air conditioning can become maladaptive both on individual and global levels (Farbotko & Gordon 2011), it might also be a necessary complement to other heatwave adaptation measures (Viguié *et al*. 2020).

[2] A statement by SOSTE Finnish Federation for Social Affairs and Health regarding social justice in climate change policy and practice. Retrieved April 28, 2021, from: https://www.soste.fi/wp-content/uploads/2020/11/2020-10-30-SOSTE_lausunto_ik%C3%A4%C3%A4ntyneet_ja-ilmasto-ohchr.pdf

7. Conclusions and suggestions for further research

Disruptions caused by climate change and extreme weather events to care services are a real threat to disabled populations, and a problem from the perspective of social justice (Walker 2015). This study showed how both home care workers and customers can be vulnerable to heat. As heatwaves will most likely become more common in the future, and as they have already caused some challenges to the services, preparedness of the services to heat might need to be improved in the future. It would be important to consider both workers' and customers' adaptation needs and support sustainable and diverse adaptation. On a wider societal scale, securing sufficient resources for home care services and creating solutions for chronic lack of staff will be important in strengthening the services' ability to cope with climate-related stressors. This is especially true as some potentially vulnerable people rely solely on these services. Although home care services can to some extent increase adaptive capacity of customers, this study also demonstrates the limitations that care providers can have in trying to cool customers apartments and provide relief from the heat, and how workers can themselves be affected not only by heat but by service-level stressors such as lack of resources. Although this study provides a limited perspective to effects of heatwaves in home care, it shows in context how the differential vulnerabilities of customers can manifest from the viewpoint of the care provider. It demonstrates how understanding the local characteristics and challenges of adaptation could complement top-down approaches to adaptation by providing some empirical evidence for assumption made about social vulnerability to heat.

More research is needed on how heatwaves have affected potentially vulnerable groups and what adaptation needs those groups might have, and how this relates to care service provision. In addition, the roles of home care customers and their families in heatwave adaptation as well as their experiences in care provision during times of emergency could be of interest to future studies and for the purposes of policy and practice. The voices of potentially vulnerable people out of reach of care networks requires more attention in the future. Anderson *et al.* (2020) point out that managers, regulators, and policy makers have an important role in how services are shaped, and this directly affects both staff and patients. Therefore, it would be important to complement this kind of research with studies that are able to critically evaluate the conditions and ways of organizing these services.

Finland is yet to adopt a heat health action plan recommended by The World Health Organization. In the absence of a national heat risk management plan the motivation and skills of local actors to implement heat risk management in their strategies and operations is emphasized. As heatwaves will likely increase, and as they have historically proven fatal to the most vulnerable populations, especially in urban environments, local actors like the city of Helsinki will most likely have to pay more attention to heat risk management in the future. In principal, municipal health care and social services have the equipment, facilities and even skills to ensure public health in the event of extreme heat.

Securing access to critical services for the most vulnerable populations is an important part of heat-wave (and climate change) adaptation. Not only should treatment of heat-related illness be accounted for, but perhaps more importantly the social aspects of heat risk such as housing characteristics, access to cool public spaces and protective social networks that can prevent heat illness and hence need for intensive care. Home care services can be in an important role mediating vulnerable people's access to these resources. On a positive note, wellbeing and general resilience of people has historically improved (Carter *et al.* 2016), which could mean that adaptation needs could be smaller in the future.

Acknowledgements

A special thank you goes to the interviewees and others in home care services whose contribution made this thesis possible in the first place. I would also like to thank my thesis supervisor Eva Heiskanen from the University of Helsinki, Annukka Kokkonen, Susanna Kankaanpää and Jaakko Heinilä from the city of Helsinki as well as my student colleagues from the thesis seminar for your helpful comments, suggestions and support.

References

Adams, W.C. (2015). Conducting semi-structured interviews. In K.E, Newcomer, H.P, Hatry, & J.S, Wholey (Eds.). *Handbook of Practical Program Evaluation* (4th ed., pp. 492-505). Retrieved from https://onlinelibrary.wiley.com/doi/book/10.1002/9781119171386

Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., Naess, L. O, Wolf, J., & Wreford, A. (2009). Are there social limits to adaptation to climate change?. *Climatic Change*, *93*(3), 335-354. https://doi.org/10.1007/s10584-008-9520-z

Alastalo, H., & Kehusmaa, S. (2018). *Kotihoidon ja ympärivuorokautisen hoidon toimintatavat 2018: Vanhuspalvelujen seurantatutkimuksen toimintayksikkökyselyn tuloksia [The practices of home care and round-the-clock care 2018: Results from surveys regarding elderly services]*. Finnish Institute for Health and Welfare. Retrieved February 8, 2021, from https://www.slideshare.net/THLfi/kotihoidon-ja-ymprivuorokautisen-hoidon-toimintatavat-2018-118997643

Alastalo, H., Vainio, S., & Kehusmaa, S. (2017). *Kotihoidon asiakasmäärät kasvussa, henkilöstön määrän kasvu ei kaikissa maakunnissa seuraa perässä [The number of customers in home care increasing, while the number of staff is not following the trend in all regions]*. (Report No. 18). Finnish Institute for Health and Welfare. Retrieved from http://urn.fi/URN:ISBN:978-952-302-899-9

Anderson, J. E., Ross, A. J., Macrae, C., & Wiig, S. (2020). Defining adaptive capacity in healthcare: a new framework for researching resilient performance. *Applied Ergonomics*, *87*, 103111. https://doi.org/10.1016/j.apergo.2020.103111

Anttonen, A. (2009). Hoivan yhteiskunnallistuminen ja politisoituminen [The societilization and politicization of care]. In A., Anttonen, H., Valokivi & M., Zechner (Eds.). *Hoiva – tutkimus, politiikka ja arki [Care - research, politics and everyday life]*. Tampere, Finland: Vastapaino.

Barnett, G., Gardner, J., & Meyers, J. (2015). Adaptation: living with a changing environment. In W., Mason & R., Walker (Eds.). *Climate change adaptation: for health and social services*. Australia: CSIRO Publishing. Retrieved from https://ebookcentral-proquest-com.libproxy.helsinki.fi/lib/helsinki-ebooks/detail.action?docID=4010517

Basu, R. (2009). High ambient temperature and mortality: a review of epidemiologic studies from 2001 to 2008. *Environmental Health*, *8*(1), 40. https://doi.org/10.1186/1476-069X-8-40

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, *2*, 8-14. https://doi.org/10.1016/j.npls.2016.01.001

Bolitho, A., & Miller, F. (2017). Heat as emergency, heat as chronic stress: Policy and institutional responses to vulnerability to extreme heat. *Local Environment*, 22(6), 682-698. https://doi.org/10.1080/13549839.2016.1254169

Carter, T. R., Fronzek, S., Inkinen, A., Lahtinen, I., Lahtinen, M., Mela, H., O'Brien, K. L., Rosentrater, L.D., Ruuhela, R., Simonsson, L., & Terama, E. (2016). Characterising vulnerability of the elderly to climate change in the Nordic region. *Regional Environmental Change*, *16*(1), 43-58. https://doi.org/10.1007/s10113-014-0688-7

City of Helsinki. (2021a, February 23). *Helsingin kotihoidon myöntämisperusteita selkeytettiin [The admission criteria for home care in Helsinki were clarified]*. Social Services and Health Care Division. Retrieved April 9, 2021, from: https://www.hel.fi/uutiset/fi/sosiaali-ja-terveysvirasto/kotihoidon-myontamisperusteita-selkeytettiin

City of Helsinki. (2021b). *Ikääntyneet Helsingissä: Asuinolot [Elderly in Helsinki: Living conditions]*. Retrieved April 22, 2021, from: https://ikaantyneethelsingissa.fi/asuminen_asuinolot

City of Helsinki. (2020). *Ikääntyneet Helsingissä: Asuntokunnat [Elderly in Helsinki: Household dwelling units]*. Retrieved April 22, 2021, from: https://ikaantyneethelsingissa.fi/asuminen_asuntokunnat

City of Helsinki. (2019). *Kotona asumista tukevien palveluiden ja ympärivuorokautisten vanhusten hoivapalveluiden omavalvontasuunnitelma 2019 [Self-monitoring plan of home care and round-the-clock care 2019]*. Social Services and Health Care Division. Hospital, Rehabilitation and Care Services Department. Retrieved April 9, 2021, from https://www.hel.fi/sote/fi/esittely/organisaatio/skh/ovs

City of Helsinki. (2018). *Sosiaali- ja terveystoimen toimintakertomus [Annual report of Health Care and Social Services]*. Social Services and Health Care Division. Retrieved February 1, 2021, from https://www.hel.fi/sote/fi/esittely/julkaisut/toimintakertomukset/

Curtis, S., Fair, A., Wistow, J., Val, D. V., & Oven, K. (2017). Impact of extreme weather events and climate change for health and social care systems. *Environmental Health*, *16*(1), 23-32. https://doi.org/10.1186/s12940-017-0324-3

Cutter, S. L., & Finch, C. (2008). Temporal and spatial changes in social vulnerability to natural hazards. *Proceedings of the National Academy of Sciences*, *105*(7), 2301-2306. https://doi.org/10.1073/pnas.0710375105

Davies, P., & Maconochie, I. (2009). The relationship between body temperature, heart rate and respiratory rate in children. *Emergency Medicine Journal*, *26*(9), 641-643. http://dx.doi.org/10.1136/emj.2008.061598

Disher, B., Edwards, B., Lawler, T., & Radford, D. (2021). Measuring Heatwaves and Their Impacts. *Air Pollution Sources, Statistics and Health Effects*, 455-475. https://doi.org/10.1007/978-1-4939-2493-6_1102-1

Drebs, A. (2011). *Helsingin lämpösaareke ajallisena ja paikallisena ilmiönä [The heat island effect in Helsinki as a temporal and local phenomenon]*. [Master's thesis, University of Helsinki, the Department of Geosciences and Geography]. Retrieved February 1, 2021, from: http://hdl.handle.net/10138/29123

Ebi, K. L. (2009). Facilitating climate justice through community-based adaptation in the health sector. *Environmental Justice*, *2*(4), 191-195. https://doi.org/10.1089/env.2009.0031

Ebi, K. L., & Semenza, J. C. (2008). Community-based adaptation to the health impacts of climate change. *American Journal of Preventive Medicine*, *35*(5), 501-507. https://doi.org/10.1016/j.amepre.2008.08.018

European Environment Agency. (2018). *Unequal exposure and unequal impacts: social vulnerability to air pollution, noise and extreme temperatures in Europe* (EEA Report No. 22/2018). Retrieved January, 2021, from https://www.eea.europa.eu/publications/unequal-exposure-and-unequal-impacts

Engle, N. L. (2011). Adaptive capacity and its assessment. *Global Environmental Change*, *21*(2), 647-656. https://doi.org/10.1016/j.gloenvcha.2011.01.019

Esplin, E. D., Marlon, J. R., Leiserowitz, A., & Howe, P. D. (2019). "Can you take the heat?" Heat-induced health symptoms are associated with protective behaviors. *Weather, Climate, and Society*, *11*(2), 401-417. https://doi.org/10.1175/WCAS-D-18-0035.1

Farbotko, C., & Gordon., W. (2011). Residential air-conditioning and climate change: voices of the vulnerable. *Journal of Health Promotion of Australia* 22: S13-S16. https://doi.org/10.1071/HE11413

Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., MacCracken, S., Mastrandrea, P.R., & White, L.L. (Eds.). (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Retrieved from https://www.ipcc.ch/report/ar5/wg2/

Finnish Institute for Health and Welfare. (2019). *Sotkanet.fi: Tilastotietoja suomalaisten terveydestä ja hyvinvoinnista: Tulostaulukko [Sotkanet.fi: Statistical information on welfare and health in Finland: Results table]*. Retrieved March 6, 2021, from: https://sotkanet.fi/sotkanet/fi/taulukko/?indicator=szbMzLLWNfaxNney1jUEAA==&region=87ZOMQIA&year=sy5zsjbW0zUEAA==&gender=t&abs=f&color=f&buildVersion=3.0-SNAPSHOT&buildTimestamp=202103120740

Finnish Meteorological Institute. (2021). *Helletilastot [Heat statistics]*. Retrieved January 8, 2021, from https://www.ilmatieteenlaitos.fi/helletilastot

Frykman, L. (2019). *The experience of a heat wave and preparations for a hot future: A case study of climate change adaptation and health risks faced by the elderly population of Trelleborg*. (Master's thesis, Lund University, Department of Climate and Environmental Sciences, Sweden). Retrieved January, 2021, from https://lup.lub.lu.se/student-papers/search/publication/8981929

García-Trabanino, R., Jarquín, E., Wesseling, C., Johnson, R. J., González-Quiroz, M., Weiss, I., Glaser, J., Vindell, J.J., Stockfelt, L., Roncal, C., Harra, T., & Barregard, L. (2015). Heat stress, dehydration, and kidney function in sugarcane cutters in El Salvador–a cross-shift study of workers at risk of Mesoamerican nephropathy. *Environmental Research, 142,* 746-755. https://doi.org/10.1016/j.envres.2015.07.007

Gillham, B. (2000). *Case study research methods.* London, England: Bloomsbury Publishing.

Hassi, J., Ikäheimo, T. & Kujala, V. (2011). *Terveydenhuollon kylmä- ja kuumaopas. Toimintamalli kokeilualueiden toimijoiden käyttöön 2011-12. [Heat and cold guide for health care. Operational model for trial regions' use 2011-12].* Northern Ostrobothnia Hospital district. Retrieved January, 2021, from http://www.kuumainfo.fi/materials/TerveydenhuollonKylmakuumaEopas.pdf

Henriksson, L., & Wrede, S. (2011) The Making of Medico-Managerial Care Work Culture in Public Home Care for the Elderly. In C., Ceci, K., Björnsdóttir & M.E., Purkis (Eds.). *Perspectives on care at home for older people*. Taylor & Francis Group. Retrieved from https://ebookcentral-proquest-com.libproxy.helsinki.fi/lib/helsinki-ebooks/detail.action?docID=957283

Herrmann, A., & Sauerborn, R. (2018). General practitioners' perceptions of heat health impacts on the elderly in the face of climate change—A qualitative study in Baden-Württemberg, Germany. *International Journal of Environmental Research and Public Health, 15*(5), 843. https://doi.org/10.3390/ijerph15050843

Hinkel, J., & Bisaro, A. (2016). Methodological choices in solution-oriented adaptation research: a diagnostic framework. *Regional Environmental Change, 16*(1), 7-20. https://doi.org/10.1007/s10113-014-0682-0

Holbrook, N. J., Gupta, A. S., Oliver, E. C., Hobday, A. J., Benthuysen, J. A., Scannell, H. A., Smale, D. A. & Wernberg, T. (2020). Keeping pace with marine heatwaves. *Nature Reviews Earth & Environment, 1*(9), 482-493. https://doi.org/10.1038/s43017-020-0068-4

Honkatukia, J. (2019). *Palvelutarve kasvaa – mutta riittääkö palveluiden tekijöitä? [Service demand increases – but is the workforce capacity sufficient?].* OPTIMI Terveys- ja sosiaalitalouden uutiskirje 1/2019 [OPTIMI Health and Social Economy newsletter 1/2019]. Retrieved from https://www.julkari.fi/handle/10024/137874

Hunt, A. P., Parker, A. W., & Stewart, I. B. (2013). Symptoms of heat illness in surface mine workers. *International Archives of Occupational and Environmental Health, 86*(5), 519-527. https://doi.org/10.1007/s00420-012-0786-0

Ibrahim, J. E., McInnes, J. A., Andrianopoulos, N., & Evans, S. (2012). Minimising harm from heatwaves: a survey of awareness, knowledge, and practices of health professionals and care providers in Victoria, Australia. *International Journal of Public Health, 57*(2), 297-304. https://doi.org/10.1007/s00038-011-0243-y

Ikäheimo, T., & Jaakkola, J. (2019). Ulkoilman äärilämpötilojen terveysvaikutukset ja niihin varautuminen [The effects of environmental temperature on health and preparedness]. *The Duodecim Medical Journal, 135*(22), 2159-66. Retrieved from https://www.duodecimlehti.fi/duo15206

Jalonen, P. & Antikainen, K. (Eds.). (2020). *Ilmastonmuutos ja kunnat [Climate change and municipalities]*. The Association of Finnish Municipalities. Retrieved January, 2021, from: https://www.kuntaliitto.fi/julkaisut/2020/2031-ilmas-tonmuutos-ja-kunnat

Jonsson, A. C., & Lundgren, L. (2015). Vulnerability and adaptation to heat in cities: perspectives and perceptions of local adaptation decision-makers in Sweden. *Local Environment, 20*(4), 442-458. https://doi.org/10.1080/13549839.2014.896326

Juhola, S., Lanki, T., Meriläinen, P., Kollanus, V., Groundstroem, F., Käyhkö, J., & Järvelä, M. (2020). *Sopeutumisen suuntaviivat ilmastopolitiikassa [Guidelines of adaptation in the Finnish climate policy]* (Report No. 2). Finnish Climate Change Panel. Retrieved January, 2021, from: https://www.ilmastopaneeli.fi/wp-content/uploads/2020/08/Ilmastopaneeli_sopeutumismuistio.pdf

Juhola, S. (2013). Adaptation to climate change in the private and the third sector: case study of governance of the Helsinki Metropolitan region. *Environment and Planning C: Government and Policy, 31*(5), 911-925. https://doi.org/10.1068/c11326

Jylhä, K., Ruosteenoja, K., Räisänen, J., Venäläinen, A., Tuomenvirta, H., Ruokolainen, L., Saku, S., & Seitola, T. (2009). *Arvioita Suomen muuttuvasta ilmastosta sopeutumistutkimuksia varten: ACCLIM-hankkeen raportti 2009 [Assessments of the changing climate in Finland for adaptation research: Report of the ACCLIM project 2009]* (Report No. 4). Finnish Meteorological Institute. Retrieved from http://hdl.handle.net/10138/15711

Kankaanpää, S. (2017). *Pääkaupunkiseudun ilmastonmuutokseen sopeutumisen uudet haasteet [New challenges of adaptation to climate change in the Helsinki Metropolitan Area]*. Helsinki Region Environmental Services Authority. Retrieved January, 2021, from https://www.hsy.fi/globalassets/ilmanlaatu-ja-ilmasto/tiedostot/pks_ilmastonmuutokseen_sopeutumisen_uudet_haasteet.pdf

Kazmierczak, A. (2015). *Analysis of Social Vulnerability to Climate Change in Helsinki Metropolitan Area: Final Report 2015*. Helsinki Region Environmental Services Authority. Retrieved January, 2021, from: https://www.hsy.fi/globalassets/ilmanlaatu-ja-ilmasto/tiedostot/social-vulnerability-to-climate-change-helsinki-metropolitan-area_2016.pdf

Kehusmaa S., Alastalo H., Hammar, T., & Luoma, M. L. (2018). *Kolmasosa vanhuspalvelujen henkilöstöstä työskentelee kotihoidossa –asiakkaista kotihoidossa on yli puolet [Third of elderly care staff working in home care – more than half of customers in home care]* (Report No. 39). Finnish Institute for Health and Welfare. Retrieved January, 2021, from http://urn.fi/URN:ISBN:978-952-343-232-1

Klinenberg, E. (1999). Denaturalizing disaster: A social autopsy of the 1995 Chicago heat wave. *Theory and Society*, *28*(2), 239-295. Retrieved March, 2021, from http://www.jstor.org/stable/3108472

Knopf, J. W. (2006). Doing a literature review. *PS: Political Science and Politics*, *39*(1), 127-132. Retrieved February, 2021, from http://www.jstor.org/stable/20451692

Kollanus, V., & Lanki, T. (2014). 2000-luvun pitkittyneiden helleaaltojen kuolleisuusvaikutukset Suomessa [Mortality effects of prolonged heat waves in the 2000s in Finland]. *The Duodecim Medical Journal, 130*(10), 983-990. Retrieved January, 2021, from https://www.duodecimlehti.fi/duo11638

Koppe, C., Sari Kovats, R., Menne, B., Jendritzky, G., & Wetterdienst, D. (2004). *Heat-waves: risks and responses* (Health and Global Environmental Change Series No. 2). World Health Organization. Retrieved from https://www.euro.who.int/en/publications/abstracts/heat-waves-risks-and-responses

Kovats, R. S., & Hajat, S. (2008). Heat stress and public health: a critical review. *Annu. Rev. Public Health*, *29*, 41-55. https://doi.org/10.1146/annurev.publhealth.29.020907.090843

Kröger T. (2019) Looking for the easy way out: Demographic panic and the twists and turns of long-term care policy in Finland. In T., Jing, S., Kuhnle, Y., Pan, & S., Chen (Eds.) *Aging Welfare and Social Policy. International Perspectives on Aging*, vol 20. Springer, Cham. https://doi.org/10.1007/978-3-030-10895-3_6

Kröger, T., & Leinonen, A. (2012). Transformation by stealth: the retargeting of home care services in Finland. *Health & Social Care in the Community*, *20*(3), 319-327. https://doi.org/10.1111/j.1365-2524.2011.01047.x

Kröger, T., Puthenparambil, J. M., & Aerschot, L. V. (2019). Care poverty: unmet care needs in a Nordic welfare state. *International Journal of Care and Caring*, *3*(4). https://doi.org/10.1332/239788219X15641291564296

Kyngäs, H., Elo, S., Pölkki, T., Kääriäinen, M., & Kanste, O. (2011). Sisällönanalyysi suomalaisessa hoitotieteellisessä tutkimuksessa [The use of content analysis in Finnish nursing science research]. *Hoitotiede*, *23*(2), 138-148.

Liu, C., Kershaw, T., Fosas, D., Gonzalez, A. R., Natarajan, S., & Coley, D. A. (2017). High resolution mapping of overheating and mortality risk. *Building and Environment*, *122*, 1-14. https://doi.org/10.1016/j.buildenv.2017.05.028

Liu, T., Xu, Y. J., Zhang, Y. H., Yan, Q. H., Song, X. L., Xie, H. Y., Luo, Y., Rutherford, S., Chu, C., Lin, H. L., & Ma, W. J. (2013). Associations between risk perception, spontaneous adaptation behavior to heat waves and heatstroke in Guangdong province, China. *BMC Public Health*, *13*(1), 1-14. https://doi.org/10.1186/1471-2458-13-913

Lowe, D., Ebi, K. L., & Forsberg, B. (2011). Heatwave early warning systems and adaptation advice to reduce human health consequences of heatwaves. *International Journal of Environmental Research and Public Health*, *8*(12), 4623-4648. https://doi.org/10.3390/ijerph8124623

Luber, G., & McGeehin, M. (2008). Climate change and extreme heat events. *American Journal of Preventive Medicine* 35:429–435. https://doi.org/10.1016/j.amepre.2008.08.021

Mallon, K., & Hamilton, E. (2015). Community-based health and social services: managing risks from climate change. In Mason, W., & Walker, R. (Eds.). *Climate change adaptation: for health and social services.* Australia: CSIRO Publishing.

Malloy, J. T., & Ashcraft, C. M. (2020). A framework for implementing socially just climate adaptation. *Climatic Change*, *160*(1), 1-14. https://doi.org/10.1007/s10584-020-02705-6

Malmquist, A., Lundgren, T., Hjerpe, M., Glaas, E., Turner, E., & Storbjörk, S. (2021). Vulnerability and adaptation to heat waves in preschools: Experiences, impacts and responses by unit heads, educators and parents. *Climate Risk Management*, 100271. https://doi.org/10.1016/j.crm.2020.100271

Martinez, G. S., Linares, C., Ayuso, A., Kendrovski, V., Boeckmann, M., & Diaz, J. (2019). Heat-health action plans in Europe: Challenges ahead and how to tackle them. *Environmental Research*, *176*, 108548. https://doi.org/10.1016/j.envres.2019.108548

Matmir, S., Reckien, D., & Flacke, J. (2017). What do New Yorkers think about impacts and adaptation to heat waves? An evaluation tool to incorporate perception of low-income groups into heat wave adaptation scenarios in New York City. *ISPRS International Journal of Geo-information*, *6*(8), 229. https://doi.org/10.3390/ijgi6080229

Mayer, M., Manu, S., Siltanen, K., Nurminen, M., Talvitie, J., Haanpää, S., & Smith, C. (2020*). Ilmastonmuutos ja sosiaali- ja terveyssektori [Climate change and the health and social sector]*. SOSTE Finnish Federation for Social Affairs and Health, Helsinki. Retrieved January 5, 2021, from https://www.soste.fi/wp-content/uploads/2020/06/SOSTE-julkaisu-2020-Ilmastonmuutos-ja-sosiaali-ja-terveyssektori.pdf

McGregor, G. R., Bessmoulin, P., Ebi, K., & Menne, B. (2015). *Heatwaves and health: guidance on warning-system development*. WMOP.

Mees, H. L., Driessen, P. P., & Runhaar, H. A. (2015). "Cool" governance of a" hot" climate issue: public and private responsibilities for the protection of vulnerable citizens against extreme heat. *Regional Environmental Change*, *15*(6), 1065-1079. https://doi.org/10.1007/s10113-014-0681-1

Meriläinen, P. (2020, November 5). *Health risks of climate change and the role of the third sector* [PowerPoint slides]. Finnish Institute for Health and Welfare. Retrieved from https://www.soste.fi/wp-content/uploads/2020/09/Ilmastonmuutoksen-terveyshaitat_soste_Meril%C3%A4inen.pdf

Miller, F. (2014, February 21). *Too hot to handle: assessing the social impacts of extreme heat* (Paper for Turning up the Heat: a symposium for SIA practitioners and researchers, Department of Environment and Geography, Macquarie University.

Ministry of Social Affairs and Health. (2021, January 19). *Luonnos / Sosiaali-ja terveysministeriön hallinnonalan ilmastonmuutokseen sopeutumisen suunnitelma [Draft / Climate change adaptation plan for sectors governed by the Ministry of Social Affairs and Health]*. Retrieved April, 2021, from https://d2htbfmhc6rwjj.cloudfront.net/attachments/d/e/9/9539c3ae24bbeba58f8012cd45cd8.pdf

Mora, C., Dousset, B., Caldwell, I. R., Powell, F. E., Geronimo, R. C., Bielecki, C. R., Counsell, C. W. W., Dietrich, B. S., Johnston, E. T., Louis, L. V., Lucas, M. P., McKenzie, M. M., Shea. A. G., Tseng, H., Giambelluga, T. W., Leon, L. R., Hawkins, E., & Trauernicht, C. (2017). Global risk of deadly heat. *Nature Climate Change*, *7*(7), 501-506. https://doi.org/10.1038/nclimate3322

Mäkinen, K., Sorvali, J., Lipsanen, A., & Hildén, M. (2019). *Kansallisen ilmastonmuutokseen sopeutumissuunnitelman 2022 toimeenpanon väliarviointi [Interim review of the implementation of the National Climate Change Adaptation Plan 2020] (Report No 2019:11)*. Helsinki, Finland: Ministry of Agriculture and Forestry. Retrieved January, 2021, from http://urn.fi/URN:ISBN:978-952-366-000-7

Naughton, M. P., Henderson, A., Mirabelli, M. C., Kaiser, R., Wilhelm, J. L., Kieszak, S. M., Rubin, C. H., & McGeehin, M. A. (2002). Heat-related mortality during a 1999 heat wave in Chicago. *American Journal of Preventive Medicine, 22*(4), 221-227. https://doi.org/10.1016/S0749-3797(02)00421-X

Neal, L. J. (1999). Neal theory of home health nursing practice. *Journal of Nursing Scholarship*, *31*(3), 251-252.

Näyhä, S. (2005). Environmental temperature and mortality. *International Journal of Circumpolar Health*, *64*(5), 451-458. https://doi.org/10.3402/ijch.v64i5.18026

Organisation for Economic Co-operation and Development. (2017). *State of the Health in the EU: Finland: Country Health Profile 2017*. OECD Publishing. Retrieved February 5, 2021, from http://dx.doi.org/10.1787/9789264283367-en

Official Statistics of Finland. (2020, May 20). *Living alone has become more common especially in the age groups of young and elderly people 2019*. Retrieved April 22, 2021, from http://www.stat.fi/til/asas/2019/asas_2019_2020-05-20_tie_001_en.html

O'Brien, K.L., and Wolf, J. (2010). A values-based approach to vulnerability and adaptation to climate change. *Wiley Interdisciplinary Reviews: Climate Change, 1* (2), 232–242. https://doi.org/10.1002/wcc.30

O'Neill, M. S., Zanobetti, A., & Schwartz, J. (2003). Modifiers of the temperature and mortality association in seven US cities. *American Journal of Epidemiology*, *157*(12), 1074-1082. https://doi.org/10.1093/aje/kwg096

Pilli-Sihvola, K., Haavisto, R., Leijala, U., Luhtala, S., Mäkelä, A., Ruuhela, R., & Votsis, A. (2018). *Sään ja ilmastonmuutoksen aiheuttamat riskit Helsingissä [Weather and climate-related risks in Helsinki]* (Report No. 2018:6). Urban Environment Division of Helsinki. Retrieved February, 2021, from https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-06-18.pdf

Public Health England. (2013). *The heat-wave plan for England.* Retrieved February 8, 2021, from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/888668/Heatwave_plan_for_England_2020.pdf

Rapeli, M., Mussalo-Rauhamaa, H. & Innola, E. (2016). *Yksityisten sosiaalihuollon asumis- ja laitospalveluja tuottavien yritysten varautuminen säätiloista johtuviin häiriötilanteisiin [Preparedness of private sector social care housing and institutional service units against disturbances caused by weather conditions, for example storms and summer heat waves]* (Report No. 2016:46). Ministry of Social Affairs and Health. Retrieved from http://urn.fi/URN:ISBN:978-952-00-3828-1

Rissanen, S. (2020, June 25). *Pitkät hellejaksot heikentävät joka viidennen työkykyä – kuumasta johtuvat sairauslomat silti harvinaisia [Prolonged periods of heat weaken the working ability of every fifth worker – heat-induced sick-leaves are still rare]* (Report No. 26). Finnish Institute of Occupational Health. Retrieved January 5, 2021, from: https://www.ttl.fi/pitkat-hellejaksot-heikentavat-joka-viidennen-tyokykya-kuumasta-johtuvat-sairauslomat-silti-harvinaisia/

Russo, S., Sillmann, J., & Fischer, E. M. (2015). Top ten European heatwaves since 1950 and their occurrence in the coming decades. *Environmental Research Letters*, *10*(12), 124003. Retrieved January, 2021, from https://iopscience.iop.org/article/10.1088/1748-9326/10/12/124003/meta

Ruuhela, R., Votsis, A., Kukkonen, J., Jylhä, K., Kankaanpää, S., & Perrels, A. (2021). Temperature-Related Mortality in Helsinki Compared to Its Surrounding Region Over Two Decades, with Special Emphasis on Intensive Heatwaves. *Atmosphere*, *12*(1), 46. https://doi.org/10.3390/atmos12010046

Ruuhela, R., Jylhä, K., Lanki, T., Tiittanen, P., & Matzarakis, A. (2017). Biometeorological assessment of mortality related to extreme temperatures in Helsinki region, Finland, 1972–2014. *International Journal of Environmental Research and Public Health*, *14*(8), 944. https://doi.org/10.3390/ijerph14080944

Saukkonen, S. M., Mölläri, K., Mäkelä, M., & Kehusmaa, S. (2020). *Yli puolella säännöllisen kotihoidon asiakkaista palvelujen käyttö on päivittäistä [More than half of regular home care recipients receive services on a daily basis]* (Report No. 34). Finnish Institute for Health and Welfare. Retrieved from http://urn.fi/URN:NBN:fi-fe2020100176315

Social Welfare Act 1301/2014

Retrieved April 30, 2021, from https://www.finlex.fi/fi/laki/ajantasa/2014/20141301

Stern, N. (2008). The economics of climate change. *The American Economic Review*, 98, 1-37. Retrieved from https://pubs.aeaweb.org/doi/pdf/10.1257/aer.98.2.1

Suomi, J., & Käyhkö, J. (2012). The impact of environmental factors on urban temperature variability in the coastal city of Turku, SW Finland. *International Journal of Climatology*, *32*(3), 451-463. https://doi.org/10.1002/joc.2277

Tuomenvirta, H., Haavisto, R., Hildén, M., Lanki, T., Luhtala, S., Meriläinen, P., Mäkinen, K., Parjanne, A., Peltonen-Sainio, P., Pilli-Sihvola, K., Pöyry, J., Sorvali, J., & Veijalainen, N. (2018*). Sää- ja ilmastoriskit Suomessa [Weather and Climate Risks in Finland - National Assessment]* (Publications of the Government's analysis, assessment and research activities 43/2018). Finland: Government Administration Department. Retrieved from http://urn.fi/URN:ISBN:978-952-287-601-0

Tuusa, R., Kankaanpää, S., Viinanen, J., Yrjölä, T., & Juhola, S. (2013). Preparing for climate change: Planning adaptation to climate change in the Helsinki metropolitan area, Finland. *Climate Change Adaptation in Practice: From strategy development to implementation*, 51-64. https://doi.org/10.1002/9781118548165.ch5

Ung-Lanki, S., Vartiainen, A. K., Kollanus, V., & Lanki, T. (2017). Helle terveysriskinä: Varautuminen ja riskinhallinta hoitolaitoksissa ja kotihoidossa [Heat as a health risk: Preparedness and risk management in care facilities and home care]. *Gerontologia*, *31*(2), 100-115. Retrieved from http://urn.fi/URN:NBN:fi-fe2018080233313

United Nations International Strategy for Disaster Reduction. (2009). *2009 UNISDR Terminology on Disaster Risk Reduction*. United Nations. Retrieved January 10, 2021, from https://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf

Vehko, T., Sinervo, T., & Josefsson, K. (2017). *Henkilöstön hyvinvointi vanhuspalveluissa –kotihoidon kehitys huolestuttava [Staff welfare in elderly services – the development of home care is worrying]* (Report No. 11). Finnish Institute for Health and Welfare. Retrieved from http://urn.fi/URN:ISBN:978-952-302-876-0

Vu, A., Rutherford, S., & Phung, D. (2019). Heat Health Prevention Measures and Adaptation in Older Populations—A Systematic Review. *International Journal of Environmental Research and Public Health*, *16*(22), 4370. https://doi.org/10.3390/ijerph16224370

Viguié, V., Lemonsu, A., Hallegatte, S., Beaulant, A. L., Marchadier, C., Masson, V., Pigeon, G., & Salagnac, J. L. (2020). Early adaptation to heat waves and future reduction of air-conditioning energy use in Paris. *Environmental Research Letters*, *15*(7), 075006. Retrieved from https://iopscience.iop.org/article/10.1088/1748-9326/ab6a24/meta

Walker, R. (2015). People with disability and their carers. In Mason, W., & Walker, R. (Eds.). (2015). *Climate change adaptation: for health and social services*. Australia: CSIRO Publishing.

Wamsler, C. (2014). *Cities, disaster risk and adaptation*. Routledge.

Wamsler, C., & Brink, E. (2014a). Moving beyond short-term coping and adaptation. *Environment and Urbanization*, *26*(1), 86-111. https://doi.org/10.1177/0956247813516061

Wamsler, C., & Brink, E. (2014b). Interfacing citizens' and institutions' practice and responsibilities for climate change adaptation. *Urban Climate*, 7, 64-91. https://doi.org/10.1016/j.uclim.2013.10.009

Wilhelmi, O. V., & Hayden, M. H. (2010). Connecting people and place: a new framework for reducing urban vulnerability to extreme heat. *Environmental Research Letters*, *5*(1), 014021. Retrieved from https://iopscience.iop.org/article/10.1088/1748-9326/5/1/014021/meta

Wistow, J., Dominelli, L., Oven, K., Dunn, C., & Curtis, S. (2015). The role of formal and informal networks in supporting older people's care during extreme weather events. *Policy & Politics*, *43*(1), 119-135. https://doi.org/10.1332/030557312X655855

Wolf, J., Adger, W. N., Lorenzoni, I., Abrahamson, V., & Raine, R. (2010). Social capital, individual responses to heat waves and climate change adaptation: An empirical study of two UK cities. *Global Environmental Change*, *20*(1), 44-52. https://doi.org/10.1016/j.gloenvcha.2009.09.004

World Health Organization. (2018). *Public health and climate change adaptation policies in the European Union: Final report*. WHO Regional office for Europe, Denmark. Retrieved from https://www.euro.who.int/__data/assets/pdf_file/0010/386965/Pagoda-REPORT-final-published-2.pdf

World Health Organization. (2011). *Public health advice on preventing health effects of heat. New and updated information for different audiences*. WHO Regional office for Europe, Denmark. Retrieved from https://www.euro.who.int/__data/assets/pdf_file/0007/147265/Heat_information_sheet.pdf

Yang, L., Liu, C., Bi, P., Vardoulakis, S., & Huang, C. (2020). Local actions to health risks of heatwaves and dengue fever under climate change: strategies and barriers among primary healthcare professionals in Southern China. *Environmental Research, 187*, 109688. https://doi.org/10.1016/j.envres.2020.109688

Yin, R. K. (2014). Case Study Research Design and Methods (5th ed.) .Thousand Oaks, CA: Sage.

Zaidi, Z. & Pelling, M. (2015). Vulnerability to drought and heatwave in London: revealing institutionally configured risk. In Birkmann, J., Kienberger, S., & Alexander, D. (Eds.). *Assessment of vulnerability to natural hazards: a European perspective*. Elsevier. https://doi.org/10.1016/C2012-0-03330-3

Zografos, C., Anguelovski, I., & Grigorova, M. (2016). When exposure to climate change is not enough: Exploring heatwave adaptive capacity of a multi-ethnic, low-income urban community in Australia. *Urban Climate, 17*, 248-265. https://doi.org/10.1016/j.uclim.2016.06.003

Appendix 1 - Interview guide for the operational staff

(Interviews were held in Finnish)

1. Background: occupation / length of work experience in home care

Theme 1: Work in home care

2. Describe your typical day in home care.

Theme 2: The effects of heat and adaptive practices

3. How did you experience the heatwave in 2018?
4. How have hot weathers affected home care customers?
    a. What did you do to cope with the situation?
5. How about work in home care?
    a. E.g. Do they increase the need for visits?
    b. E.g. Has there been challenges with medication spoilage?
    c. E.g. Have they affected your own wellbeing and ability to work?
    d. What did you do to cope with the situation?

Theme 3: Preparedness

6. Have you received instructions during heatwaves? Describe.
    a. E.g. Have they been sufficient?
    b. E.g. Could something have been done better?
7. Is there enough information to cope with heat (for the purposes of home care)?
8. What would in your opinion be the best way to share knowledge regarding heatwaves?

Theme 4: Challenges and solutions

9. How does the holiday season affect the work in home care?
10. Do you have time to do everything you want during customer visits?
11. How would you develop preparedness and adaptation to heat in home care?

Theme 5: Social networks

12. Describe the collaboration between families and home care.
    a. E.g. Are families informed about heat risks?
13. Are there any other actors with whom to develop collaboration regarding heatwaves (e.g. third sector organizations)?

Finally: Would you like to add something to the previous conversation?

Appendix 2 - Interview guide for the strategical staff

(Interviews were held in Finnish)

1. Background: occupation / length of work experience in home care

Theme 1: Work in home care

2. Describe your typical day in home care.

Theme 2: The effects of heat and adaptive practices

3. How did you experience the heatwave in 2018?
4. How have hot weathers affected home care customers?
5. How about work in home care?
    a. E.g. Do they increase the need for visits?
    b. E.g. Has there been challenges with medication spoilage?
    c. E.g. Effects to workers wellbeing?

Theme 3: Preparedness

6. Are heatwaves considered in planning of the work?
7. Is there enough information to cope with heat (for the purposes of home care)?
8. What would in your opinion be the best way to share knowledge regarding heatwaves?

Teema 4: Challenges and solutions

9. How is the lack of resources visible in the everyday practices of home care?
    a. How have you coped with these challenges?
10. How does the holiday season affect the work in home care?
11. How would you develop preparedness and adaptation to heat in home care?

Theme 5: Social networks

12. Describe the collaboration between families and home care.
    a. E.g. Are families informed about heat risks?
13. Are there any other actors with whom to develop collaboration regarding heatwaves (e.g. third sector organizations)?

Theme 6: Risk perception

14. Wat do you think about heat risks in home care in the future?

Finally: Would you like to add something to the previous conversation?

Appendix 3 - List of original quotations

”(…) mut hyvin usein se on nyt sitä, et me tehdään vaan se välttämätön. Et me turvataan ne kriittiset tarpeet, me huolehditaan siitä et ihminen saa ruokaa, ihminen saa tarvitsemansa lääkkeet, ja sit me lähetään seuraavaan paikkaan huolehtii niist samoist asioist (…).” (p. 23)

”(…) me ollaan aika väsyneitä sillon näillä hellepäivillä, et ne vie aika paljon voimia. Et päätä särkee ja tosi rankkaa siis sekä hoitajille ja asiakkaille.” (p. 26)

”Mut et siin on tietysti taas se, että me ollaan jo ihan niinkun täystyöllistettyjä ihan näiden peruskäyntien osalta, niin sit tietysti niinkun se, että akuutisti et pystytäänkö lisäämään niitä käyntejä, niin sekin on aika haasteellista. Mutta toki, jos asiakkaan vointi sitä edellyttää, niin sillon niit käyntejä lisätään.” (p. 27)

”Tietysti varsinkin jonkun asunnon kokoon tai näihin tuuletusmahdollisuuksiin ei hirveesti pysty vaikuttaa (…).” (p. 29)

“Tää juominen on ollu aina niin kauan kun mä muistan ollu ongelma. Mut se korostuu noissa helteissä (…). Sillon tulee aina, ja sillon tulee enempi niit päivystyskeikkojaki usein just sen kuivumisen takia, varsinki sit jos on pidempi hellejakso, niin sit jossain vaiheessa se kuivuminen rupee tulee niille ihmisille. Kun me ei olla 24 hoo paikalla, ja sit se, et meidän käyntien aikana me ei voida pakottaa sitä juomaan.” (p. 31)

”Ja tietysti on niitä, jotka myöskin vie sen vanhuksensa siitä helteisestä kuumasta asunnosta vaikka mökille, jos sinne mökille on mahdollista mennä, ja mahdollista pärjätä. Että kyllä siis toki omaisten osuus on tosi iso sillon, kun heitä on, ja heillä on mahdollisuuksia.” (p. 32)

“(…) oltiin tietysti omaisiin yhteydessä, ja pyydettiin et he kävis myöskin siellä lisäksi sitte, ja toisivat niitä sellasia tuulettajia sinne kotiin, et saatais sillä niitä koteja tuuletettua (…).” (p. 32)

“(…) realistisesti on niin, että jos meillä olis väkee riittävästi, niin tai sopivasti kaikkialla, niin tuota paljon muuta ei tarvittais, koska sillon me pystyttäis niitä asioita tekemään. Pystyis sitä taukoa pitämään ja näin.” (p. 33)

Appendix 4 - Coding tree

(Main category)	(Subcategories)
Adaptive capacity	Adaptive practice
	Families
	Immobility
	Living conditions
	Risk-perception
	Loneliness
	Autonomy
	Resistance to change
	No air conditioning
	External capacities / resources
	Summertime is nice
Effects of heat	On customers
	On workers
	On services
	Heat in apartments
Adaptation / response	Instructions from organization
	Development options
Work in home care	Lack of resources
	Nature of work / description
	Temporary staff
	Unpredictability
	Summer workers
	Summer vacations